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Plants reputed to be Poisonous to Stock in Australia.

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No apology is needed for presenting a *resumé* of our knowledge of plants which are poisonous to stock or are reputed to be so. The subject is dominated by empiricism; in fact, very little work of a truly scientific nature has been carried out in this direction. Perhaps my demonstration of how little has been done may be an incentive to physiologists and chemists to give increased attention to it.

It is distinctly understood that I do not acquiesce in the idea that all the plants referred to are poisonous. On the contrary, I have frequently reported on some of them as harmless. To accept, without proof, the statements made as to the poisonous nature of certain plants, would be as great an error as to take the diametrically opposite course—to assume that no plants contain poisonous principles.

It is no new thing for scientific men and others to hold very divergent views in regard to the properties of a particular plant, one looking upon it as harmless and even a good fodder-plant, while another is satisfied as to its toxic properties. In this connection the following letter from the celebrated collector Drummond to Sir William Hooker is interesting. It was written in 1840, and refers to *Gastrolobium*:—

"I wish now to send you some particulars respecting the poisonous plant which I have mentioned to you in various former communications. Much contradictory discussion has taken place on this subject, Mr. Preiss, the German botanist, whom you know, being unwilling to believe that a poisonous vegetable of any kind exists in the Swan River colony, or, indeed, in the whole of New Holland. Nay, so far has he carried this opinion, as to recommend the very plant which has been pronounced to possess deleterious properties, as the best thing which the Agricultural Society could cultivate as artificial food for stock. I must confess that this conduct caused me some vexation, since it was myself and Mr. Harris, Secretary of the Agricultural Society, who had arrived at an opposite conclusion, our opinion being founded on experiments that we had instituted, and which seemed to us perfectly undeniable." (*Hooker's London Journal of Botany*, vol. I, p. 94.)

Hardly any portion of my work fills me with a greater sense of responsibility than that which pertains to the giving of advice in regard to reputed poisonous plants. A few years ago the matter was easy enough. Statements of alleged poisoning of stock by plants were accepted freely, and I think I may fairly say often with but little examination. In my paper on the subject in

the *Gazette* for February, 1895, I have emphasised the point that a "stock-killer" may not be a "stock-poison." This offers a wide field for inquiry, and one which, I think, belongs for the most part to the physiologist. The University student, desirous of winning his spurs on the field of science, will find here a peculiarly tempting prospect,—no lack of work, and opportunity of directly applying the brilliant teaching and research in animal physiology for which our University is distinguished.

Hoven or tympanitis is a very common and frequently fatal complaint amongst stock, and may be briefly described as distension with wind through immoderate feeding. Many succulent vegetable foods will cause this, but leguminous plants seem peculiarly liable to induce it. The human animal frequently can, by adopting the precautions of the practised diner, eat indigestible viands with apparent impunity, but a hungry herbivorous animal exercises no discretion when appetite impels and abundance of food is available. As a result, it may be stated that it is frequently as fatal to animals to allow them to eat unrestrictedly of what is, under normal conditions, sweet, rich fodder, as it would be to administer strychnine to them. Mr. S. Dixon's remarks under "Lotus" are to the point, and most of my readers will call to mind instances of deaths of cattle from hoven through eating lucerne, clover, sorghum, &c.

Besides hoven, many deaths of stock which have been attributed to feeding on certain plants have, on further investigation, been shown to have been caused by anthrax or Cumberland disease.

The great majority of the plants referred to in this paper are indigenous to Australia. I have added notices of a few exotic plants which are of especial interest to us in Australia.

Besides the toxic plants, we have plants which are "stock-killers," in that they induce hoven, as already stated. Then again, we have plants which may cause death through mechanical irritation. To this class belong *Helichrysum apiculatum* and others of the Compositæ, which form felted masses inside the stomachs of animals; *Stipa*, or spear-grass, whose barbed seeds are frequently fatal, and others which may be mentioned on a future occasion.

A number of references to the literature on the subject will be found scattered throughout my paper; following are a few references to papers which treat the subject in a more or less comprehensive manner, that is, do not refer to a single species:—

BAILEY (F. M.) and GORDON (P. R.)—**Plants reputed Poisonous and Injurious to Stock.** *Govt. Printer, Brisbane*, 1887.

Illustrated. Refers largely to native plants.

See also *Ann. Report Dept. Agric., Queensland*, 1890-1, p. 44, and subsequent years, for records of several additional plants.

DIXON (S.)—**Remarks on some Indigenous Shrubs of South Australia suitable for Cultivation as Fodder.** *Proc. Roy. Soc., S.A.*, VIII, 14.

Incidentally touches on fatalities in stock.

HAMLET (W. M.)—**Anthrax in Australia: with some account of Pasteur's method of vaccination.** *Trans. Intercol. Med. Congress of Australasia, Melbourne*, 1889.

The properties of several alleged poisonous plants are incidentally referred to.

MACOWAN (Prof.)—**References to Leguminous Poisoning and symptoms resembling it.** *Cape Agric. Journ.*, 11th July, 1895, p. 349.

A valuable bibliographical paper which I have found very useful.

MAIDEN (J. H.)—**Notes on some American and Australian Plants injurious to Stock.** *Agric. Gaz.*, IV, 679 (1893).

See also **Native Plants Poisonous to Stock,** *ib.* VI, 52 (1895).

MESTON (R.)—**Report upon Diseases in Sheep and Cattle.**

With an Appendix by C. Moore, Director, Botanic Gardens, Sydney.

Votes and Proceedings, Legislative Assembly, 1858-9.

A report on a visit to the Western districts, undertaken with a view to throw light upon the causes of the mortality amongst flocks and herds. One of the earliest scientific reports on the subject.

TRYON (H.)—**Plants Poisonous to Stock.** A Review. *Brisbane Courier*, 24th May; *Queenslander*, 28th May, 1887.

DILLENIACEÆ.

Hibbertia glaberrima, F. v. M., and *H. longifolia*, F. v. M.,

have both been sent to Mr. F. M. Bailey from Queensland localities as suspected poison-plants. (*Ann. Rep. Dept. Agric. Q.*, 1890–91, p. 44). Hibbertias, yellow-flowering plants (usually dwarf shrubs), are very largely developed in New South Wales, but I have never heard of their having been suspected as poisonous. As a rule they are far too harsh to be acceptable to stock.

Besides occurring in Queensland, the plants named are found in South Australia.

PAPAVERACEÆ.

Argemone mexicana, Linn.—" White Thistle " or " Yellow Poppy."

This yellow-flowering plant with prickly, thistle-like, glaucous (whitish) leaves is frequently accused of being poisonous to stock. It is an introduced plant, and is usually found on good soil on river-banks or river-flats.

ZYGOPHYLLEÆ.

Zygophyllum iodocarpum, F. v. M.

This plant was suspected to have poisoned stock on Nekarboo Station quite recently. Occasionally other species are also sent as suspected poison-plants. The genus is reputed to be deleterious to stock both in South Europe and South Africa. In India, however (*Dict. of Econ. Prod.*), it is stated that camels are fond of *Z. simplex*, but that no other animals will touch it on account of its offensive odour.

Z. iodocarpum is found in all the colonies except Tasmania.

LEGUMINOSÆ.

It will be found that pastoralists accuse plants belonging to this order (Pea family) of poisoning, or at least of injuring the health of, their stock as frequently as they do plants of all the other orders put together. In an order so extensive and so widely distributed, it is not surprising that it includes plants differing very widely in properties—some nutritious and harmless without question, *e.g.*, the Pea (*Pisum*), others dangerously poisonous, *e.g.*, *Physostigma venenosum*, the Calabar bean. But in regard to very many plants of this order which cause the death of stock, it is surely not understating the case when I say that it is a reflection on modern science that we

have to hesitate as to the cause. Australians are not particularly to blame for this state of things, as they have to face precisely the same problems as their brethren in South Africa and the western United States. The Leguminosæ are particularly liable to cause death in stock from tympanitis or hoven; in other words, from fatal distension of the stomach in animals which may eat immoderately of them. Thus deaths frequently occur through stock eating too much clover or lucerne, and succulent plants belonging to many other natural orders (even grasses) will produce like fatal results.

Considering the terrible money loss which is inflicted on pastoralists and others through their sheep, cattle, and horses mysteriously dying through eating leguminous plants, it would surely be a matter of good business for them to arrange for a competent physiologist, with a selected band of assistants and co-operators, to take the field, thoroughly inquire into the cause of these fatalities, and suggest means of prevention. At present, while agreeing that certain plants are the cause of death, we can neither be certain of their precise physiological effects, nor can we suggest remedial measures other than empirical ones.

We will now proceed to consider some reputedly injurious Leguminosæ in detail:—

Acacia verniciflua, A. Cunn.—"Stink-wood Bush."

A case of supposed poisoning of cattle from eating this plant, in Tasmania, is recorded in *Journ. Tas. Council of Agric.*, September, 1892.

Found in all the colonies except Western Australia and Queensland.

Cassia.

The leaves of a species in the Wilcannia district of New South Wales were reported as having caused purging in horses and cattle, after eating only a small quantity. I received no specimens. It may be borne in mind that Senna leaves are the product of species of this genus.

Cassia lævigata, Willd., and *C. occidentalis*, Linn.

Two introduced plants; have both been sent to Mr. Bailey as poison-weeds. The former species, which is widely diffused in the coast districts, has often been sent to me as a suspected plant.

Cassia Sophera, Linn.; var., *schinifolia.*

This indigenous plant, which is rapidly spreading in localities in which it was not previously indigenous, is now and then reported on suspicion of having poisoned stock. For a note on it see *Agricultural Gazette* vi, 243 (1895).

Found in South Australia, New South Wales, Queensland, and Western Australia.

Cassia Sturtii, R. Br.

Specimens of this shrub have been sent to Mr. Bailey as a suspected poison bush.

Found in all the colonies except Tasmania.

Castanospermum australe, A. Cunn.—"Bean-tree" or "Moreton Bay Chestnut."

The large "beans" or "chestnuts" are eaten by horses and cattle, but they are very indigestible and frequently cause fatal results, as every resident on the northern rivers is fully aware.

I have dealt with the subject at some length in the *Agricultural Gazette* for January, 1894, page 2, under the headings "The Bean-tree as a Plant injurious to Stock," also "The Bean-tree furnishing Food for Man," to which I beg to refer my readers.

Found in New South Wales and Queensland.

Crotalaria alata, Hamilt.

An Indian plant suspected of being poisonous to stock in Queensland. (*Report Department of Agriculture, Queensland*, 1891–2, p. 49.)

Crotalaria Mitchelli, Benth.—"Yellow Darling Pea."

This has on several occasions been sent to me as a suspected poison-plant, it being supposed to produce the same effects on cattle as those produced by *Swainsona*.

See page 12, where a note is given of the reputed poisonous nature of *Crotalaria* in the United States.

Surely it is something more than a coincidence that this genus should be complained of by stock owners in countries so wide apart, and I am morally certain that my correspondents were absolutely ignorant of a congener being similarly suspected in North America.

Found in South Australia, New South Wales, and Queensland.

Gastrolobium spp., especially *G. obovatum*, Benth.; *G. trilobum*, Benth.; *G. spinosum*, Benth.; *G. oxylobioides*, Benth.; *G. calycinum*, Benth.; *G. callistachys*, Meissn.; *G. bilobum*, R.Br.

Commonly known as "Poison Bushes." At the Blackwood River, according to Oldfield, *G. calycinum* is known as the "York Road Poison Bush." *G. bilobum* is the "Heart-leaf Poison Bush," and *G. ovalifolium*, "Bloom Poison Bush."

These plants are dangerous to stock and are hence called "Poison Bushes." Large numbers of cattle are lost annually in Western Australia through eating them.

"The finest and strongest animals are the first victims; a difficulty of breathing is perceptible for a few minutes, when they stagger, drop down, and all is over with them. After the death of the animal the stomach assumes a brown colour, and is tenderer than it ought to be; but it appears to be that the poison enters the circulation, and altogether stops the action of the lungs and heart.* The raw flesh poisons cats, and the blood, which is darker than usual, dogs; but the roasted or boiled flesh is eaten by the natives and some of the settlers without their appearing to suffer any inconvenience." (Drummond, in Hooker's *Journal of Botany*.)

"The blossoms are also frequently eaten by animals, and are, I think, the most poisonous part, for the greatest number of sheep are lost from the poisonous effect of this plant at the period of its inflorescence. When the seeds fall on the ground, the wild pigeons greedily feed and fatten on them; if the crops of these pigeons, containing the seeds, be eaten by dogs, they die; yet the pigeons themselves, when dressed, are good food, and at that season are eaten in large numbers by the settlers. Horses, so far as is known, are not affected by it, at least this is the prevailing opinion, although

*See also an account of some physiological experiments to ascertain the nature of the poison, *Pharm. Journ.*, vi., 312.

it is disputed by some of the settlers." (T. R. C. Walter, in *Pharm. Journ.*, vi., 311.)

With sheep which have eaten the herb, the best treatment has been found to fold them, or shut them up in a yard, so closely packed that they can hardly move, and to keep them thus without food for thirty-six hours. (See an interesting account in *Pharm. Journ.*, vi., 311, also *Tas. Journ.*, iii., 313 (1849).

In the *Flora Australiensis* a statement is quoted that *G. bilobum* is the worst of the "Poison Bushes." For a note on this species see *Agricultural Gazette*, v. 141 (1894). Helms (*Proc. R.S.*, *S.A.*, xvi. 348,) records that *G. spinosum*, Victoria Desert, Western Australia, is poisonous to camels.

All found in Western Australia.

Gastrolobium grandiflorum, F.v.M.—"Wall-flower or Desert Poison Bush."

Baron Mueller identified this plant as having poisoned large numbers of cattle and sheep on the Cape River, and at the sources of the Burdekin and Flinders Rivers in 1863–4. He recommended frequent burning off on the stony ridges it frequents, with the view to its suppression or eradication. See *Trans. Roy. Soc. Victoria*, vi., 147 (1861–4); *Journ. Bot.*, iii., 325.

Found in Queensland.

Gompholobium uncinatum, A. Cunn.

This small shrub is noteworthy as being very hurtful to sheep that may eat of it (*Treasury of Botany*).

Drummond, in Hooker's *London Journal of Botany*, i., 95 (1842), experimented on a sheep and a goat with a small quantity of a leguminous plant which would seem to belong to the genus *Gompholobium*, and the animals used in these experiments died speedily. I may mention, however, that common as the genus *Gompholobium* is in New South Wales, I have never yet heard of it having poisoned stock.

Found in New South Wales.

Goodia.

Goodia is closely related to such plants as the Laburnums, Brooms, Gorse, Hoveas, &c. There are only two species, and both are confined to Australia, their botanical names being *G. lotifolia*, Salisb., and *G. medicaginea*, F. v. M. They are tall shrubs, the first named attaining, in favourable circumstances, the dignity of a small tree. They have yellow flowers. *G. lotifolia* is found more or less plentifully all along the coast district and coast mountain ranges. *G. medicaginea* does not occur in our Colony. *G. lotifolia* is sometimes known as "Clover-tree" in Tasmania. Booroo-molie is a Queensland aboriginal name.

Last year Mr. Forester Benson, of Bega, wrote to the Department about "a tree locally known as Indigo," which proved to be *Goodia lotifolia*. He had been informed that the foliage is poisonous, and that stock travelling from the Monaro to the coast often die from eating it. There are large quantities of it growing on the edges of the main road between Colombo and Nimitybelle.

Subsequently Mr. Benson reported:—"I have made inquiries amongst cattle-drovers and others regarding the supposed poisonous nature of *Goodia lotifolia*. They state that cattle eat it greedily, and are affected with what is locally called black scour. The tongue becomes black, the hide acquires a bluish tint, and becomes rough and bound. They gradually become weak and emaciated, and eventually die."

In the *Journal of the Bureau of Agriculture* (W.A.), 5th February, 1895, a correspondent described a plant (identified as *Goodia medicaginea*), as having killed twenty-five head of his best cattle, by stoppage of the bowels. It was stated that the poisoning of pasture animals had arisen from this plant before, and it was pointed out that as the plant seeds freely, and the seeds germinate readily, the plant might become exceedingly dangerous if not subdued.

At a meeting of the Agricultural Bureau of South Australia, a correspondent from Yorketown reported that his cattle were dying, and described their symptoms. He sent down a weed which he supposed to be poisonous, and the cause of the deaths, but the General Secretary of the Bureau pronounced it to be a species of *Goodia,* "and quite harmless" (*Garden and Field*, March, 1895, page 369).

A good deal of attention has been given in South Australia to the effects of *Goodias* on stock, and Mr. Molineux, the General Secretary of the Bureau, says that Mr. A. B. Robin, of Nuritoopna, Mr. Goode, of Port Caroline, in the south-east, and Mr. J. G. O. Tepper, pronounce that *Goodia medicaginea* is eagerly sought by stock of all kinds, so much so, that they eat it out, root and branch. Mr. Robin cut the plant and fed it to his horses. As regards *G. lotifolia*, which prefers moister localities than does *G. medicaginea*, Mr Tepper says that stock eat it without any evil effects following.

Here we have evidence in regard to *Goodias* which is more or less conflicting. It does not appear fully proved that they are really toxic* ; that is to say, *poisonous*, in the sense that strychnine is, but that they are *stock-killers* under some circumstances, appears to be proved beyond doubt. I have drawn attention to the distinction in the *Gazette* for February, 1895, page 57. These leguminous plants (which include the Darling Pea, *Gastrolobiums, Crotalarias,* and other stock-killers), are the cause of great loss on the part of owners of stock, and we really have but little evidence yet in regard to them. From South Australian experience it would appear that they are not only not poisonous, but that they are really useful fodder-plants. If so, then deaths that result from eating them, must be caused from indigestion, through the animals surfeiting themselves with the green leaves, which cause them to be blown, or by eating too much of the fibrous twigs, which cause stoppage of the bowels. Of course it is quite possible that they may contain some principle in small quantity which acts injuriously upon some organ, as Dr. C. J. Martin suspects, or has proved, to be the case with the Darling Pea (*Swainsona*).

We, therefore, cannot speak with definiteness about our *Goodia,* and I trust that this note will be the means of eliciting some further evidence. It is a very difficult thing to come to a really satisfactory conclusion in regard to the causes of the death of stock suspected of having eaten poison plants. We must carefully eliminate all matters which may cloud the issue, but it is very certain that, unless we can actually come at the cause of death in such suspected cases, any remedial measures we may adopt might be likened to the action of a blind man attempting to shoot at a target of whose position he knows nothing. Of course it is quite possible he *may* hit it, but such shooting could hardly be of educational value to others.

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* Are the pods the most injurious part of the plant? If so, the toxic principle, if any, may be looked for by chemists in the seeds, where it is generally found, if at all, in the *Leguminosæ.*

Indigofera australis, Willd.

"Australian indigo," closely allied to the indigo of commerce (*Indigofera tinctoria*), but not to be confused with *Swainsona*, commonly called "indigo" in this Colony.

This widely diffused tall shrub is occasionally sent to Sydney as a suspected plant. It is frequently nipped by cattle and horses. In one locality it is supposed to induce red-water in cattle feeding on it. Sometimes it is cut down, as its baneful effects are feared, though with the qualification that it is only injurious to cattle unused to feeding upon it. [See a note in *Agricultural Gazette*, ii. 663 (1891).]

Found in all the colonies.

Lotus australis, Andr., and *Lotus corniculatus*, Linn.

These plants are often reputed poisonous in Australia; for example, Baron Mueller (*Trans. R. S. Victoria*, vol. vi., 148, 1861–4) speaks of the "deadly effect" of *L. australis*, and that it causes sheep to perish, in some cases, in half an hour.

"I am inclined to believe that many leguminous plants reputed to be poisonous are not really so, but that an excess of either foliage or seeds eaten by a hungry animal throws off such an abundance of gases, that "hoove" ensues, which is nothing more than an excessive distension of the stomach, pressing against the diaphragm, preventing the lungs from working, and the animal is really strangled to death. To this cause I attribute all the deaths (and they are very numerous), caused by *Lotus australis*, var. *Behrii*, really an excellent fodder plant, akin to the lucernes, but when seeding, and especially after rain, if hungry sheep are allowed to feed greedily upon it they die by hundreds, while sheep in confinement, and fed solely upon it, do not die, but actually thrive, as was shown some years since in Adelaide." (S. Dixon, *op. cit.*)

L. corniculatus is called "Bird's-foot trefoil" in England, and in Europe it is recognised as an excellent fodder plant. For an exhaustive account (with figure) of it, see *The Best Forage Plants* (M'Alpine's translation of Strebler and Schröter's work).

L. australis is found in all the colonies, *L. corniculatus* in all the colonies except Queensland and Western Australia. Both are common in grassland in many parts of this Colony, and I cannot think that either is poisonous.

Oxylobium parviflorum, Benth.—"Box poison."

Bentham (*B. Fl.*) states this is said to be one of the worst of the poison plants. [See also Dr. Rosselloty (*Trans. Intercol. Med. Congress*, 1889).] Our widely diffused *O. trilobatum* does not seem to have fallen under suspicion.

Found in Western Australia.

Swainsona.

The effect on sheep of eating freely of various species of *Swainsona* (particularly *S. galegifolia* and *S. Greyana*) is so well known that one requires to do but little more than to refer to the literature of the subject. That sheep which take to eating these plants may so firmly acquire the habit that they will eat no other food; that as the result of eating such food they become wrong in the head, imagining (amongst other things) that small

objects in the path are great obstacles; that they never fatten, and finally die, are all well ascertained facts. But a rational explanation is not so easy. Chemical analysis has failed to isolate a toxic principle, and examination of the bodies of sheep (pea eaters), has not yet thrown clear light upon the subject. The investigation is one of singular difficulty, in which time is an important element; but Dr. C. J. Martin, a distinguished physiologist, is devoting himself to the inquiry, and no doubt, in a few months, the precise physiological effects will be determined. The subject is a broad one, and wrapped up with the general question of the fatal effects on herbivora through eating certain other leguminous plants.

Following are a few incomplete notes in regard to certain species of *Swainsona*, and it may be mentioned that both with *Swainsona* in Australia and *Astragalus* in the United States, it is a fact, perfectly well ascertained, that some species are excellent fodder plants, while others produce the mysteriously fatal effects.

Swainsona galegifolia, R.Br.—"Darling Pea," "Indigo Plant."

This is a dreaded plant from the great amount of loss it has inflicted on stock-owners. Its effect on sheep is well known; they separate from the flock, wander about listlessly, and are known to the shepherds as "pea eaters," or "indigo eaters." When once a sheep takes to eating this plant it seldom or never fattens, and may be said to be lost to its owner. The late Mr. Charles Thorn, of Queensland, placed a lamb which had become an "indigo eater" in a small paddock, where it refused to eat grass. It, however, ate the indigo plant greedily, and followed Mr. Thorn all over the paddock for some indigo he held in his hand.

At Taroom (Q.) horses were hobbled for the night at a place where much of this plant was growing. On the following morning they were exceptionally difficult to catch, and it was observed how strange they appeared. Their eyes were staring out of their heads, and they were prancing against trees and stumps. The second day two out of nine died, and five others had to be left at the camp. When driven they would suddenly stop, turn round and round, and keep throwing up their heads as if they had been hit under the jaw; they would then fall, lie down for a while, rise, and repeat the agonising performance. On one station, in the course of a few weeks, eight head were shot, having injured themselves past hope of recovery. *Plants Injurious to Stock* (Bailey and Gordon).

The Rev. Dr. Woolls, however, points out (*Proc. Linn. Soc., N.S.W.*, vii, 315), that from experiments made near Mudgee, New South Wales, it does not appear that this species is deleterious when eaten with other herbage.

Hamilton (*Proc. Linn. Soc., N.S.W.* [2], ii, 273) records that he knows of a case of thirty fowls dying through eating the seeds of this species. (*S. lessertiifolia,* a synonym).

See also Guthrie (F. B.) and Turner (F.) on a supposed poisonous plant, a description and analysis of the "Darling Pea," "Indigo," "Cranky Pea," &c. (*Swainsona galegifolia*, R.Br.), *Agricultural Gazette*, iv, 84 (1893). No alkaloid was found, and no conclusive evidence was offered as to the nature of the poisonous principle (if any) contained in the plant. This paper also contains notes of the experiences of New South Wales graziers in regard to the plant.

See also notes in *Agricultural Gazette*, iii, 330 (1892), and iv, 678 (1893).

Found in New South Wales and Queensland.

Swainsona Greyana, Lindl.—"Poison Bush."

This plant is reported to cause madness, if not death itself, to horses. The poison seems to act on the brain, for animals affected by it refuse to cross even a small twig lying in their path, probably imagining it to be a great log. Sometimes the poor creatures attempt to climb trees, or commit other eccentricities (Woolls). It is regarded with great horror on the Darling, especially in dry seasons, when other herbage fails. Baron Mueller believed in the poisonous properties attributed to this particular species. (*Trans. R.S. Victoria*, vol. vi, 1861–4).

"I may add that this plant is popularly supposed to produce a sort of insanity, ending in some cases in death, in stock that feed upon it. I am of opinion that this is incorrect; I have never seen any stock actually feeding upon it, but I have seen horses eat freely, without any evil effect, of another species of the same genus (?), which grows plentifully on the black soil flats which are at times inundated by the waters of the Darling. The Hon. William Macleay, who has had large experience in a district where this plant grows, informed me a few days ago that he also was of opinion that it is not poisonous to stock." (H. R. Whittell, in *Proc. Linn. Soc., N.S.W.*, ix, 179.)

It may be said at once that the effects on animals of this species and *S. galegifolia* are probably identical in every respect, and I have quoted various authors in order that we may have the rather complex effects of eating these plants described in different language.

Found in South Australia, Victoria, New South Wales, and Queensland.

Swainsona phacoides, Benth.—"Indigo" or "Liquorice."

I have it on the authority of a most experienced man that this is considered a most valuable fodder-plant in the Walgett district.

All the colonies except Tasmania.

Swainsona procumbens, F.v.M.

It may be mentioned that this species, called "Broughton Pea" in South Australia, is reputed not to be poisonous to stock. It would be desirable for graziers and others to make specific statements as to the injurious nature, or the fodder-value, of the other species of *Swainsona*.

South Australia, Victoria, New South Wales, Queensland.

Templetonia egena, Benth., and *T. retusa*, R. Br.

Stated to produce spasm and paralysis in stock.—(*Gardeners' Chronicle* [3], xii, 16.)

T. egena in all the Colonies except Tasmania; *T. retusa* in Western Australia and South Australia.

Tephrosia purpurea, Pers., and *T. rosea*, F.v.M.

These species possess properties deleterious to stock. The latter was reported from the Flinders River, Queensland, as a poison herb.—(Bailey and Gordon.)

It may be mentioned that these plants are used by the aborigines for the purpose of stupefying fish, in order that they may be readily caught.

South Australia, New South Wales, Queensland, Northern Australia.

The Loco-disease of the Western United States.

This mysterious disease amongst stock, which bears so strong a resemblance to (and is probably identical with) the indigo-disease in this Colony, is attributed to plants belonging to the genera *Astragalus* and *Oxytropis*, and also to a less extent to the genera *Sophora* and *Crotalaria*, and perhaps others.

The Colorado Legislature passed a measure on 14th March, 1881 (repealed in April, 1885), enacting that "Any person who shall dig up, not less than 3 inches below the surface of the ground, any loco or poison weed during the months of May, June, or July, shall receive a premium of 1½ cents. per pound for each pound of such weed dug up, to be paid out of the State Treasury, as hereinafter provided. Provided that such weed shall not be weighed in a green state, but shall be thoroughly dried and weighed." Nearly 200,000 dollars were paid in bounties.

Following are Prof. D. O'Brine's conclusions in regard to the loco-weeds, after very careful research and review of the work of others:—

"We have been unable to find any alkaloid in the plants examined, though we get alkaloidal reactions from the loco and the alfalfa (lucerne).

"We have not been able to produce any physiological action upon rabbits with the extract from the loco in any of its forms. In the case of the sheep in the southern part of the State said to have been locoed, it has long been known that the disease was caused by parasites in the liver.

"The *post-mortems* made showed such a variety of diseased conditions that in our judgment they could hardly be due to one or the same cause.

"It has always been noticed that when the feed on the range is good, locoed animals are scarce. The range about Fort Collins contains the loco in large quantities, but I have never seen a locoed animal except up on the mountain range or foothills.

"In our experience the animals affected and the subjects for *post-mortems* were in every case young animals, mostly under 4 years old, the great majority yearlings and 2-year-olds.

"I have long been persuaded that the person who investigates the subject of loco should spend considerable of his time on the range, and notice very carefully the habits of the animals, the food they eat, and the water they drink. The subject has not been investigated to the extent that its importance demands.

"It is never wise to draw hasty conclusions from imperfect data, or from a few *post-mortems*. Judgment had better be withheld until the subject is more thoroughly investigated."

I give some brief references (chiefly bibliographical), in regard to this disease, because of the obvious necessity for investigators in this Colony to be acquainted with it. Prof. O'Brine's statement shows that the knowledge of American loco-disease is pretty much in the same unsatisfactory state as that of Australian indigo-disease.

ANDERSON (F. W.)—**On Loco-weed.** *Botanical Gazette* (*U.S.A.*), July, 1889.

FAVILLE (S.)—*Report Colorado State Agric. Coll.* (Jan., 1885). On *ante-* and *post- mortem* examinations of locoed sheep and a horse.

KENNEDY (J.)—**On Loco-weed** (*Astragalus mollissimus*). *The Druggists' Circular and Chemical Gazette* (*U.S.A.*), Oct., 1888.

Paper read before the Texas Pharmaceutical Association. The experiments were conducted upon the dog. Mr. Kennedy comes to the conclusion that the "loco-plant" does not possess any of the poisonous properties attributed to it by popular superstition. He, however, adds that the immense destruction of stock with which it is charged may have been caused by some poison-plant heretofore unsuspected.

MAYO (N. S.)—**On Loco-weed.** *Kansas Agric. Expt. Station, Bulletin* No. 35. Abstracted in *Agric. Gazette,* IV. 677 (1893).

O'BRINE (D.)—**Progress Bulletin on the Loco and Larkspur.** *Colorado Agric. Expt. Station, Bulletin* No. 25 (1893).

A paper valuable not only for the careful research it indicates, but also for its bibliographical notices.

POWER (F. B.)—**Notes on Loco-weeds.** *Rocky Mountain Druggist,* Jan., 1891, p. 5 (from *Hoffman's Pharm. Rundschau*).

The species of *Crotalaria* and *Astragalus* believed to contain very small amounts of toxic alkaloids.

SAYRE (L. E.)—**Loco-weed.** *Druggists' Bulletin* (Detroit, U.S.A.), III, 145 (1889).

A valuable paper. The author's confessedly incomplete observations tend to show that the plants are not poisonous.

WILLIAMS (T. A.)—**Some Plants Injurious to Stock.** *Kansas Agric. Expt. Station, Bulletin* No. 33.

Abstracted in *Agric. Gazette*, IV, 677 (1893).

New Mexico Weeds. Bulletin No. 1, page 29, "Loco-weed," with figure and account of *Astragalus mollissimus. Bulletin New Mexico Agric. Station* (1894).

Loco-disease. *Report Dept. Agric. U.S.A.* 1874, p. 159; 1878, p. 134; 1886, p. 75.

We will now give a few notes on individual genera reputed to cause loco-disease.

Astragalus

is the genus of plants most commonly accused of inducing the loco-disease, and *A. mollissimus* is reputed to be the worst offender. *A. lentiginosus* and *A. Hornii* are also in bad repute.

As with *Swainsona*, so with *Astragalus*, we find some species which form useful fodder-plants, *e.g.*, *A. hypoglottis*, rattle-pod; *A. caryocarpus*, buffalo-pea and buffalo-clover; *A. canadensis*, Canada milk-vetch; *A. adsurgens.* Jared G. Smith, an eminent authority on the subject, alludes in "Fodder and Forage Plants," a work published by the U.S. Department of Agriculture during the present year, to the poisonous nature of the loco-weeds. The belief as to the poisonous nature of loco-weeds is as widely held in America as is a similar belief in regard to the indigos with us.

Crotalaria sagittalis, Linn.,

is one of the loco-weeds of the United States, (*see* O'Brine and others). T. A. Williams (*op. cit.*) lays such stress on this plant that he styles the result of feeding upon these plants as "Crotalism, a new disease in horses," and describes the symptoms at some length. They appear to be identical with loco-disease and indigo-disease.

I have already drawn attention to the fact that the genus *Crotalaria* is looked upon as furnishing stock-poisons in New South Wales and Queensland. At the same time it is worthy of remark that the genus so largely developed in India does not appear to be looked upon as injurious to stock in that country.

Oxytropis Lamberti, Pursh.

This is a common "Loco-weed," usually referred to in company with *Astragalus*, which see.

Sophora secundiflora, Lag.,

is accused in Mexico of producing tetanus in animals that feed on the leaves or seeds. The seeds contain an exceedingly poisonous alkaloid known as *Sophorine*. (*Kew Bulletin*, 1892, 216.)

S. tomentosa, Linn.,

which extends to Australia (N. S. W. to Northern Australia), contains a poisonous alkaloid, which is contained in largest quantities in the seeds. *See* Greshoff (*Ber.* XXIII. 3537; *Journ. Chem. Soc.* LX. 335).

Other Exotic Leguminosæ reputed to be Poisonous to Stock.

The following references are by Professor MacOwan, *Cape Agricultural Journal*:—

Cytisus scoparius, Link.—Poisonous effect. Neumann, para. "Diseases," Fleming's transl., p. 572.

Cytisus proliferus, L.f.—Effect on horses. *Vide* "Tagasaste," par Peret and Sagot, pp. 24-31. *Vide Cape Agricultural Journal*, VII, p. 453.

Lathyrus sativus, L., Muttar.—*Veterin. Record*, July 21, 1894; January, 1895; February, 1895. *Agricultural Journal*, V, p. 151; VII, pp. 400 and 592. *Kew Bulletin*, October, 1894, pp. 349-352.

Lessertia annularis, Bth.—The probable cause of Nenta, MacOwan, stock food-plants. *Cape Monthly Magazine*, August, 1877; reprinted *S.A. Agricultural Almanac*, 1887, p. 111.

Melilotus parviflora, Desf.—In New South Wales said to paralyse horses. *N.S.W. Agricultural Gazette*, II, p. 16; compare *op. cit.*, II, p. 124.

DROSERACEÆ.

Drosera.

Various species of this genus, commonly known as "Sun-dews," are popularly believed to poison stock, and are sent in for report. My experience is that suspicion usually falls on a form of *D. peltata*. The earliest record I can find is by Wilhelmi (Port Lincoln, South Australia), who stated that *Droseras* "have proved poisonous to sheep; if eaten by them produced rapid death."

Droseras grow in damp places, and even if stock eat these plants (which is quite possible, although I have never seen them do so), it seems most likely that the injury which may result is rather the effect of the boggy country—country which often diminishes the vital energy of stock, even if the marshy land be not the nidus for the specific germs of disease (*e.g.*, Anthrax).

FICOIDEÆ.

Mullugo Glinus, Harv. (Syn. *M. hirta*, Thunb.)

Has been sent as a suspected plant from Euston during the present year I would not notice this had it not been sent by different persons, on different occasions, as a suspected plant. There is no doubt, however, that it is not only harmless, but that it has some forage value. Its close relations are *Mesembryanthemum* and *Tetragona* (Native Spinach), both well-known fodder plants.

All the colonies.

UMBELLIFERÆ.

Apium leptophyllum, F.v.M.—"Wild Parsley."

Occasionally eaten by stock. It is worthy of note that this plant (in common with others of the genus) is sometimes acrid and injurious when grown in damp soils, while those grown in dry soils are usually little more than carminative. It is, doubtless, capable of much improvement by careful cultivation. This plant is not endemic in Australia.

At the same time, it is perfectly well ascertained that certain Umbelliferæ are recognised as poisonous by eminent scientific authorities in Europe. I may instance "Hemlock" (*Conium maculatum*), "Water Hemlock" (*Cicuta virosa*), "Great Water Parsnip" (*Sium latifolium*), and the "Dropworts" (*Œnanthe*).

Victoria, New South Wales, and Queensland.

Trachymene australis, Benth.—"Wild Parsnip."

This plant is frequently accused of having poisoned stock. I would refer my readers to an illustrated article on this subject in the *Gazette* for October, 1894. Since that article was written I have received several communications accusing the plant of possessing poisonous properties, and only a short time ago (October, 1896), it has been accused in the newspapers of having destroyed 1,500 sheep in one night on Gidgee Station. There is no doubt that the plant (particularly the root) is acrid and indigestible, and might cause death from hoven in stock which eat immoderately of it; this is easy enough, as at certain seasons it is frequently the only green herb existing over a large area. At the same time, the evidence points to the very heavy mortality having been the result of anthrax.

All the colonies.

The Australian Umbelliferæ require careful investigation with regard to their effects on stock.

COMPOSITÆ.

Helichrysum apiculatum, DC.

Mr. D. C. Le Souef wrote to the Melbourne *Australasian* pointing out that on Three Hummocks Island, Bass' Straits, some of the sheep occasionally so fell off in condition that they died from apparent starvation. *Post mortem* examination showed their stomachs to contain quantities of balls of various sizes, formed by the matting together of the hairlets of this plant. The plant is found in all the colonies, is about 6 inches high, and often makes large areas gay with its small heads of yellow flowers.

All the colonies.

Myriogyne minuta, Less.—"Sneezeweed."

This plant was believed by the late Baron von Mueller to be injurious to stock, but my own experience does not support this view. It is very common in damp land, and stock as a rule avoid it. Perhaps the injury, if any, it causes, is of a mechanical nature, as in the case of the *Helichrysum*.

All the colonies.

Pterigeron adscandens, Benth.

Specimens of this plant have been frequently sent to Brisbane as a poison herb. (Bailey.)

Queensland and Northern Australia.

GOODENIACEÆ.

Velleia paradoxa, R. Br.

This particular weed grows in a paddock on the river in which Messrs. Mackay, of Gunywarildi, had fourteen almost fat bullocks. Seven of them died rather suddenly, and they are of opinion that it was caused by eating this plant. (Inspector of Stock, Warialda, Aug., 1893).

All the colonies.

CAMPANULACEÆ.

Isotoma axillaris, Lindl.

The late Baron von Mueller believed this plant to be poisonous to stock.

Victoria, New South Wales, and Queensland.

Isotoma Brownii, G. Don.

Drummond (Hooker's *London Journal of Botany*), refers to the supposed poisoning of sheep in Western Australia by a "Lobelia." (*L. hypocrateriformis—Isotoma Brownii*).

Backhouse (*Narrative*, p. 535), also refers to this matter, stating that large numbers of sheep died almost immediately; it is supposed from eating a plant of this genus.

Western Australia.

Lobelia pratioides, Benth.

The death of a number of cows at Geelong, Victoria, in 1873, was by Baron von Mueller attributed to this plant. For copies of the correspondence and reports on the subject, see *Report, Department of Agriculture, Vic.*, 1873, p. 104.

South Australia, Tasmania, Victoria, New South Wales.

Pratia erecta, Gaud. (Syn. *Lobelia concolor*, R.Br.).

Mr. F. M. Bailey reported that the fatalities amongst horses in the Laidley district of Queensland (1890), were to be attributed to this plant.—(*Annual Report, Department Agriculture, Queensland*, 1890-91, p. 45.)

The same plant was suspected of poisoning stock by the stock inspector, Forbes, N.S.W.—See *Agricultural Gazette*, ii, 141 (1891).

South Australia, Victoria, New South Wales, Queensland.

SOLANEÆ.

Anthocercis.

The late Baron von Mueller stated that all plants of this genus were poisonous to stock.

Duboisia myoporoides, R.Br.—"Corkwood."

This well-known coastal plant (for a figure and full description see *Agricultural Gazette*, iv, 845, 1893), was believed by the late Baron von Mueller to be poisonous to stock. It is undoubtedly injurious to man, and the Baron probably heard of stock eating it, a case of which has not come under my notice.

New South Wales, Queensland.

Nicotiana glauca, Grah.—"Tree tobacco," "Wild tobacco."

This South American plant is now very extensively diffused in the interior of this Colony, for it has the power of resisting drought to a remarkable

degree. It is often planted to give a quick-growing shelter of, say, a dozen feet in height, and will submit to the roughest usage. It is occasionally, very occasionally, sent to Sydney as a poison plant, but, I think, without sufficient proof.

Professor M'Owan, of the Cape of Good Hope, says:—"There are conflicting accounts respecting the poisonous qualities of this plant in this country. Occasionally we hear of young ostriches being poisoned through eating its leaves, but shall be glad to get any authentic reports on the subject, as it appears to be very likely to be injurious to all kinds of stock."

Mr. F. M. Bailey says:—"It cannot be very poisonous, because fowls eat it greedily in autumn when green-stuff is scarce, and horses browse upon it, and neither fowls nor horses appear to be injuriously affected by it."

Nicotiana suaveolens, Lehm.

This is the small native tobacco with white, sweet-smelling flowers. It is found in most parts of the Colony, but is particularly abundant in the interior, where, especially in dry seasons, it covers large areas, frequently to the exclusion of other vegetation. There can be no doubt that it is poisonous to stock. It possesses narcotic properties, like smoking-tobacco.

All the colonies except Tasmania.

Solanum eremophilum, F.v.M.

An old drover stated that he has repeatedly seen sheep and cattle die after eating this plant between Cobham and Mount Arrowsmith (New South Wales).

South Australia, New South Wales, and Queensland.

Solanum nigrum, Linn.

This widely diffused weed is by some persons believed to be poisonous, by others innocuous. For an account of its alleged poisonous nature see *Report, Department of Agriculture, Victoria*, 1873, p. 104. A few months ago much correspondence in the Melbourne press took place between certain persons who believe in its poisonous nature and others who do not. My own opinion is that it is not poisonous, though it is quite possible that if the fruits be eaten unripe, or if the plant be grown in damp shady places, it may possess acridity and produce gastric disturbance. The ripe fruits are made into jam in parts of this Colony, and are also eaten by children raw. The fruits are eaten by human beings in other parts of the world.

Solanum Sturtianum, F.v.M.

A form of this species has been sent to me from Thargomindah, Queensland, suspected to have poisoned cattle. It grows on stony country and red soil flats, but not on black flooded ground.

South Australia, New South Wales to North Australia.

SCROPHULARINEÆ.

Gratiola.

The late Baron von Mueller wrote that this genus, and particularly *G. Peruviana*, is poisonous to stock. It may be mentioned that *G. officinalis* (also found in this Colony) is believed in Switzerland to be poisonous or injurious to cows.

ASCLEPIADEÆ.

Sarcostemma australe, R. Br. Called "Caustic Bush Plant," or "Caustic Vine," in Queensland, and "Gaoloowurrah" by the aboriginals at Port Darwin.

In the Warrego district, Queensland, a great number of fat cattle have perished from eating this plant. The death of sheep from eating it is also well authenticated. (Bailey and Gordon.)

Yet Mr. S. Dixon stated that he had not known stock to touch this plant till the summer of 1880–1, when the cattle on the eastern plains of South Australia lived upon it, without water, for some months of continued drought. (*Proc. R.S., S.A.*, iv, 135.)

"It is of a curious habit, preferring to grow into a tree or shrub, into which it climbs and hangs down. It grows very long, but something appears to break it off. I do not think stock eat it, though it appears to be eaten off." (Mrs. Kennedy, of Wonnaminta, in a letter to the writer.)

All the colonies except V. and Tas.

MYOPORINEÆ.

Eremophila maculata, F. v. M.—Called "Native Fuchsia" in parts of *Queensland.*

It is often sent to Sydney as a suspected plant. Some persons look upon it as a good fodder-bush.

It does not appear to be dangerous to stock accustomed to eat it, but to others, travelling stock particularly, Mr. Hutchinson, of Warrego (Q.), considers it to be deadly. The effects of this plant are always worst after rain. It appears to be most dangerous when in fruit. (Bailey and Gordon.)

All the colonies except Tas.

Myoporum deserti, A. Cunn.—"Ellangowan Poison-bush" of Queensland; "Dogwood Poison-bush" of New South Wales.

This appears to be a well-authenticated poison-bush, but apparently only when in fruit. It is reported from Ellangowan, Darling Downs, Queensland, that of a flock of 7,000 sheep, passing Yandilla (Q.), 500 succumbed to eating this plant. (Bailey and Gordon.)

All the colonies except Tas.

LABIATÆ.

Stachys arvensis, Linn.

My personal experience is that no introduced weed is more frequently sent to head-quarters as a poison plant than the present one. From all parts of the Colony in which this plant occurs it is sent, and the same inquiry is reiterated, "Does it cause staggers in horses"? Many people are quite emphatic on the subject, and simply report it as indubitably causing this disease. I would refer my readers to a paper, "Revised Report on the disease Shivers, *i.e.*, Tremors, in Horses, Cattle, and Sheep," by E. Stanley, Government Veterinarian, *Agricultural Gazette*, vi, 32 (1895), which, to my mind, satisfactorily shows that the weed is not the direct cause of the disease.

THYMELACEÆ.

Pimelea hæmatostachya, F. v. M.

This very handsome plant might with advantage be introduced into garden culture, but it is one of the worst of poisonous herbs, and often causes the loss of hundreds of sheep, yet their lives could, perhaps, be saved by slitting their ears soon after they had eaten the herb. (Bailey.)

Queensland.

If the poisonous nature of this plant be established beyond doubt, it is, perhaps, singular that the common white-flowered *Pimelea linifolia*, to be found in nearly every paddock in the Colony, is quite harmless to stock.

EUPHORBIACEÆ.

Beyeria viscosa, Miq.

This plant was reported to the Stock Department of New South Wales in 1886 as having poisoned 500 sheep near Moree.

All the colonies.

Carumbium populifolium, Reinw. (Syn. *Omalanthus populifolius*, Grah.; *O. Leschenaultianus*, A. de Juss.) "Native Poplar."

Baron von Mueller states (*Australasian Chemist and Druggist*, September, 1883) that "cattle when extensively browsing on the foliage of this species are apt, when grass is failing in the dry season, to succumb to the effects of this plant, the final cause of death being hæmaturia; indeed, Mr. W. Kirton, of Bulli, Illawarra, informs the writer that large losses in the herds occurred there, particularly last season."

See also an article entitled "Red Water in the Northern Territory" (*Garden and Field*, Adelaide, November, 1894, p. 243), where Mr. Maurice Holtze expresses the conviction that the disease is caused through hungry animals feeding on this tall shrub.

V., N.S.W., Q., N.A.

Euphorbia alsinæflora, Baill.

This plant is said to be a dangerous poison-herb to sheep.

N.A.

Euphorbia Drummondii, Boiss.

This prostrate, small-leaved plant is held in great respect in the drier parts of the Colony (where it is most abundant), as a poison-plant. This belief is all but universal. Every year finds correspondent after correspondent reporting this plant as having devastated his flocks or herds, while conversations with squatters and others show that they have quite made up their mind in regard to the plant. We cannot, therefore, but admire the boldness of Mr. E. Stanley, our Government Veterinarian, who not only has undertaken to prove (and I think has been successful), that the plant is not only innocuous, but even that it is a good fodder-plant. Mr. Stanley's first paper appeared in the *Agricultural Gazette* for 1890; a revised edition will be found in the same journal for September, 1896, p. 319, to which I desire to refer my readers for further information.

See also Bailey and Gordon, S. Dixon (*op. cit.*), also *Bulletin, Dept. Agric., Victoria*, No. 1, p. 42. (June, 1888.)

All the colonies.

Euphorbia eremophila, A. Cunn.

This plant should be, perhaps, placed in the "suspected" list. In the western interior some people say it is highly poisonous, others, as usual, say that they have seen sheep eat it with not the least injurious result.

Mr. Bäuerlen gathered a quantity of this plant for the Technological Museum, and appended the following note:—"The plants I send I gathered in a horse paddock. There was plenty of evidence on the plants that horses or cattle browse on them, but no injurious result is recorded at the station."

"I have lost a lot of sheep that have died from eating the plant. It grows only along the creeks. Sheep that have eaten it take from three to four days before they die. The bladder in most cases I found very full and discoloured. Between the skin and the flesh, and between the shoulder and ribs, there is a kind of yellow slime. The bowels in most cases are very full of wind, and yellow frothy little bubbles. It will be interesting to know that only young sheep have eaten this plant, the reason being that the old sheep *know* it is not good for them." (D. H. Dunlop, Quandary, *viâ* Louth.)

It was suspected to have poisoned three horses and one bull at Nekarboo Station during the present year.

All the colonies except Tas.

Excæcaria Agallocha, Linn.

Stated by Baron von Mueller and others to be poisonous to stock.

N.S.W. and Q.

Phyllanthus Gastræmii, Muell. Arg.

Accused in the coast districts of being poisonous to cattle.

N.S.W. and Q.

Phyllanthus lacunarius, F. v. M.

This plant, "stated by the native blacks to be poisonous," was forwarded to the Stock Department in February, 1894, on suspicion of having poisoned a number of sheep, mostly weaners, in one of the paddocks, of the Momba Pastoral Co., Mount Murchison (Wilcannia District, New South Wales). These specimens were forwarded by the Stock Inspector at Wilcannia.

The same plant was sent under similar circumstances in 1896 by the Stock Inspector at Broken Hill.

S.A., V., N.S.W., and Q.

URTICEÆ.

Trema aspera, Blume.—"Peach-leaved poison-bush"; "Elm"; "Rough Fig"; A "Kurrajong."

This shrub is firmly believed by some to be poisonous. It is very indigestible, the bark being full of fibre. It is said to stop all food passing through bullocks, causing death in a few days.

"The most carefully-made preparations of both the green and dried plant were neither bitter, nor had they any effect upon frogs." (Dr. T. L. Bancroft).

All the colonies except S. and W. A.

SANTALACEÆ.

Exocarpus cupressiformis, R. Br.

"While on the Castlereagh, New South Wales, a person on whose testimony I could rely assured me that the branches of this tree are injurious to horses when they eat them. In a bad season, when fodder was scarce, he had cut down some of these trees and given the branchlets to his horses for the purpose of keeping them alive. The effect was extraordinary, for, although none of the animals died, they appeared to suffer for some time from some cerebral disease similar to that occasioned by eating certain leguminous plants." (*Woolls*, Lectures on Veg. Kingdom, 70).

All the colonies.

CYCADEÆ.

Macrozamia spp.—"Zamia Palm," "Burrawang," "Wild Pine-apple."

In Queensland, Western Australia, and New South Wales, a disease affecting cattle, and known as "Rickets" or "Wobbles," has been attributed to their feeding on various species of *Macrozamia*, *M. spiralis*, *M. Fraseri*, *M. miquelii*, being specifically mentioned. The term "Rickets" is in strictness a misnomer, as the disease is not rachitis, but a partial paralysis of the kind-quarters, the diminished muscular power giving rise to a wobbling gait. In some cases it increases in intensity so that the animal finally loses the power of locomotion, cannot rise, and so starves unless assistance is given.

"The disease causes very little systematic disturbance, and when the *Zamia ingesta* has left the system, and the partial paralysis has become established in a degree, not too severe, cattle will fatten as readily as ever. The disease may be induced in any of the domestic animals by causing them to eat the chaffed Zamia leaves mixed with other food, or by administering concentrated solutions of the mucilage which is found in various parts of the plant." (Edwards.)

Macrozamias are gregarious plants; in some parts of the country they form the principal herbaceous vegetation over large areas. As a rule they are found on poor country, where the grasses are sparse and but slightly nutritive. *Macrozamia*-eating begins in an occasional manner; it develops, in many cases, into a habit, so much so that stock often prefer it when more nutritious food is available.

Mr. H. H. Edwards, the Government Veterinary Surgeon of Western Australia, Dr. T. L. Bancroft, of Brisbane (*Brisbane Courier*, 29th October, 1892), and others, have investigated the disease with more or less thoroughness, but it cannot be said that the mystery surrounding it has been altogether dispersed. Reference will, of course, be made by inquirers to the memoirs of the investigators; but, it appears to me, it is at present by no means conclusively disproved that the disease is not the result of mal-nutrition—the disturbance of the digestive system, of the urinary system, the emaciation, the weakening of the hind-quarters, all seeming to result from the consumption by the animal of a large bulk of fibrous, indigestible matter, which substance has peculiar zest for the animal. Scientific investigation does not yet show that Zamia-eaters exhibit toxic effects, and the disease, like "Indigo disease," remains one to be grappled with by modern methods of physiological research.

The report by Mr. H. H. Edwards (*Journal Bureau of Agric.*, *W.A.*, 27th November, 1894) appears to me the most valuable one which has as yet appeared on this subject.

The following references may be useful—

EDWARDS (H. H.)—**Report on the disease known as "Rickets" or "Wobbles."**

Journal Bureau of Agriculture, W.A., 27th November, 1894.

For other references to the eating of Zamia Palm, and methods for its eradication, see same journal, issues of July, 1894, p. 119, 7th August, 1894, p. 131, and 4th June, 1895.

LAUTERER (J.)—**Macrozamia, especially respecting its poisonous resin; said to produce the Rickets of cattle.**

Abstract of a paper read before Royal Society of Queensland, published in *Chemist and Druggist of Australasia*, December, 1895 (p. 272).

TURNER (F.) **The Zamia Palm** (*Macrozamia miquelii*, F.v.M.) **and its relation to the disease known as Rickets in cattle.**

Agric. Gazette N.S.W. IV. (March, 1893).

Cycas media, *R. Br.*

This plant, sometimes erroneously known as "Zamia," induces, at Bowen, Rickets in cattle, taking the place, for Northern Queensland, of the Macrozamias, which are so deleterious to stock in more southern and western localities.

ORCHIDEÆ.

Dipodium punctatum, R. Br.

"I have long suspected this plant to be poisonous, and on Friday last I saw a fat sheep eat one of the plants late in the evening, and the sheep was dead on Saturday morning. It evidently died early in the night; the inside of the sheep having a pink appearance, and the sheep lying in such a position as to lead to the belief that it died from the effects of some strong narcotic poison." (Correspondent from Cooma District, N.S.W.)

This statement is interesting, not only because this is the first time this orchid has been suspected of mischief (the Order is a harmless one as a very general rule), but also because it is a fair type of the imperfectly conclusive observations on which judgment is commonly based.

All the colonies except W.A.

IRIDEÆ.

Homeria collina, Vent.; var., *miniata*.

This rather ornamental plant, a native of South Africa, has strayed from gardens in one of the suburbs of Melbourne, and has destroyed a number of cattle which browsed upon it. (*See* a pamphlet by D. McAlpine, published by the Department of Agriculture, March, 1893.)

LILIACEÆ.

Bulbine bulbosa, Haw.—"Native or Wild Onion," "Native Leek."

Mr. W. N. Hutchison, Sheep Inspector, Warrego, Queensland, reports of this plant: "Its effects on cattle, sheep, and horses are almost the same, continually lying down, rolling, terribly scoured, mucous discharge from the nose, of a green and yellowish colour. Cattle survive the longest; sheep take some three days, and horses will linger for a week." In *Plants injurious to Stock* (Bailey and Gordon) two cases of poisoning are also instanced.

All the colonies except W.A.

The residents of Port Lincoln, South Australia, are desirous that this plant should be proclaimed under the Noxious Weeds Act as dangerous to stock. (*Journ. Bureau Agric.*, Adelaide, 1889). The plant has several

times been sent to me as a poisonous weed. The following note by O'Shanesy is interesting:—"On reaching the Nogoa River our attention was attracted by a lovely green treeless plain which overlooks the river—so green, indeed, that we first imagined it to be a field of maize; but which, on our approaching it closer, proved to be a luxuriant natural crop of "shallots," *Bulbine bulbosa.* This is a pretty liliaceous plant, bearing a long raceme of yellow flowers, and a reddish root resembling a carrot, of which pigs are said to be very fond, though not converted to any use by the aborigines. Although not possessing any deleterious properties, cattle of any description will not eat it unless very much pressed by hunger. (O'Shanesy, Cont. to Flora of Q., p. 24.)

Bulbine semibarbata, Haw.—"Wild Onion."

Mr. George Dorward, of Port Lincoln, S.A., directed attention (*Journ. Bureau Agric. S.A.*, ii, 13) to this weed, which is locally spreading at an alarming rate. No stock of any kind will touch it, and it therefore is not a noxious plant in the sense *B. bulbosa* is alleged to be, but it is becoming a pest on account of occupying the place of good fodder-plants. The statement, however, that of these two species one is a poisonous and the other a non-poisonous plant requires investigation.

All the colonies.

Stypandra glauca, R. Br.

This herb is looked upon in Western Australia as a poisonous plant, causing the "blind disease" in sheep. It is common in our Colony, but I have not heard that it is a suspected plant here. For a note on the subject see *Agricultural Gazette*, V, 142 (1894).

All the colonies except T. and S.A.

Xanthorrhœa.

"The settlers in the vicinity of Jervis Bay inform me that the young shoots of the grass-tree, when in blossom, if eaten by cattle, give them a complaint called 'Cripples.' It appears to affect their joints, and doubles them up, and they have to be removed to other pastures, when they gradually recover." (J. S. Allan.)

This is surely akin to or identical with the disease known as "Rickets" in cattle. See *Macrozamia*.

CYPERACEÆ.

Schœnus Brownii, Hook. (Syn. *S. apogon*, Roem. *et* Schult.)—"Fluky Grass."

In 1893 this plant was sent by two correspondents in New England suspected to have caused fluke in sheep. I have dealt with the matter at some length in a note which will be found in *Agricultural Gazette*, IV, 142 (1893).

All the colonies except W.A.

GRAMINEÆ.

Some grasses, *e.g.*, *Paspalum scrobiculatum*, L., the Khoda Millet or Hureek of India, and indigenous also to this Colony and Queensland, are injurious to stock, perhaps because of the presence of parasitic fungi, which induce the formation of toxic bodies. To what extent our native grasses are deleterious because of the presence of such fungi, or from any other cause, is a matter for investigation, as our knowledge of the subject is at present quite fragmentary.

The "Wild Onion," or "Sweet-scented Garlic."

(*Allium fragrans*, Vent.)—A Very Bad Weed.

I do not know who will step forward and claim the honor of the introduction of this neat little, white-flowering liliaceous plant, which blooms regularly in a number of places in the coast districts every November. It was originally introduced into the Colony as an ornamental plant, and so, if it could be kept within bounds, it still would be, but where it has broken bounds it becomes a serious pest. To give an idea of its seriousness, there is no doubt that it is the most formidable weed in the Botanic Gardens, at Sydney, being even worse than the nut-grass (*Cyperus rotundus*). I suppose I am within the mark when I say it costs £100 a year to keep it in check in that one establishment, which, at 4 per cent., represents a capital sum of £2,500. It is more insidious than the nut-grass, because it is more brittle. It seems as if a perfect plant grows from every fragment left in the ground. I direct attention to it in the most serious manner.

Vernacular Names.—It is commonly known as "Onion," or "Wild Onion," about Sydney. "Sweet-scented Garlic" is a name sometimes given to it, because it is allied to garlic, while the flowers are slightly perfumed. It is not to be confused with *Bulbine bulbosa*, the well-known "Wild Onion," although in grass-land, before flowering, the plants are not very dissimilar.

Botanical Name.—*Allium*, Latin for garlic; stated to be derived from a Celtic root *all*, hot or pungent; *fragrans*, Latin adjective, meaning fragrant or perfumed.

Botanical description.—

Leaves a foot long, weak, diffuse, glaucous, linear, channeled, obtuse, and twisted at the end.

Scape smooth, erect, round, a little longer than the leaves, glaucous, with a little red at the base.

Umbel—As many as sixteen-flowered in some umbels, with a short, scarious, two-leaved spatha.

Pedicels long, slender, rigid.

Flowers very fragrant, six-cleft, turbinate, with white, spreading, blunt, equal, concave segments, and a green tube.

Stamens (six) nearly the length of perianth, erect, inserted into the mouth of the tube.

Filaments linear lanceolate, white, green at base.

Pollen yellow.

Ovary cylindrical, six-ribbed, very smooth.

Style the length of stamens.

Stigma small, simple, depressed.

The above description is taken from *Edwards' Botanical Register*, vol. xi, p. 898, *Allium fragrans*, var. *nepalense*, except that the number of flowers in the umbel of our plant is as many as sixteen in contradistinction to six in the typical variety.

How to get rid of it.—In an ordinary garden-border perhaps the best method is to dig each plant up very gingerly, so as to be careful to take up every fragment. In lawns (where it spreads like infection) frequent mowing is the only cure, while on hard ground it should be shaved off close to the ground as often as it makes its appearance, with the result that it will eventually die out; but above all be on the look out for it, and tackle it on its first appearance on a lawn or in a garden. Endeavour to recognise it, and then give it no quarter. When it has got a thorough hold on the ground it is almost impossible to get rid of it. Never let it flower if possible.

A Congener.—Attention may be invited to a close relation of our pest, viz., ***Allium vineale***, Linn., which is such a terrible pest in many parts of the Southern United States. I trust that, by taking *A. fragrans* in time, it will never become such a pest as *A. vineale* is to many American farmers and orchardists. This is the subject of a special bulletin (No. 2, vol. viii, July, 1895) of the Agricultural Experimental Station of the University of Tennessee. It is considered by many to be "the vilest weed-pest in our State." Equally serious reports are made from New Jersey, Maryland, Virginia, North Carolina, South Carolina, and Georgia. In Texas its place is taken by ***Allium striatum.*** The most serious complaint against it is that "it ruins our milk, butter, and beef," a danger which may, though to a less intense degree, be looming before us as regards *A. fragrans*.

Where found.—South Europe and North Africa, from whence it has spread to most warm countries.

In our Colony it prefers good soil, fairly moist, hence low-lying, rich alluvial soils, but it is very accommodating in this respect.

Reference to plate.—A. Fruit (slightly enlarged); B. Seeds (magnified).

Allium fragrans, Vent.

'Wild Onion"

(116 134-96.)

A List of the Insectivorous Birds of New South Wales.

By ALFRED J. NORTH, C.M.Z.S.,
Ornithologist to the Australian Museum.

PART II.

(Continued from Vol. VII, p. 397, 1896.)

64. MALURUS CYANEUS, *Ellis*. Superb Warbler, "Blue Wren," "Cock-tail."

Malurus cyaneus, Gould, Birds of Austr., fol. ed., Vol. III, pl. 18 (1848); North, Nests and Eggs, Austr. Bds., p. 112 (1889).

A RESIDENT and well-known species inhabiting most parts of Eastern New South Wales. It has decided preference for those localities near the coast which are covered with a scrubby undergrowth; and it is also a common species about orchards and gardens. Few of our birds are better known about the public parks and gardens of Sydney than the pert and lively Superb Warbler; the rich velvety blue and black attire of the male frequently arresting one's attention as it trips across the grassy lawns, or pours forth its cheerful song from the top of some low bush. The nest of this species is dome-shaped, with a narrow entrance in the side; it is constructed of dried grasses, and lined inside with feathers, hair, or the soft down from the seed-pods of the "Cotton Plant." Usually it is built in a low bush, but occasionally in long grass. The eggs are three or four in number for a sitting, of a pale fleshy-white ground colour, spotted and blotched with different shades of reddish-brown; length, 0·67 x 0·5 inch. The breeding season of the Superb Warbler commences in August and continues until the end of February. Frequently the Rufous-tailed Bronze Cuckoo (*Lamprococcyx basalis*) deposits its egg in the nest of this species. The figure represents an adult male; the female and young males are brown.

65. MALURUS LAMBERTI, *Vigors and Horsfield*. Lambert's Superb Warbler, "Chestnut-backed Superb Warbler."

Malurus lamberti, Gould, Birds of Austr., fol. ed., Vol. III, pl. 24 (1848); North, Nests and Eggs of Austr. Bds., p. 113 (1889).

The range of the Chestnut-backed Warbler extends over most parts of the Colony; it is, however, far less frequently met with than the preceding species. Its nest is like that of *M. cyaneus*, but it is usually placed in a tuft of long grass, or in a low shrub in which the grass is growing through it. Eggs, three or four in number for a sitting, of a pale fleshy-white, spotted or blotched with dark red; length, 0·66 x 0·48 inch.

NOTE.—Contributions from the Australian Museum, by permission of the Trustees.

66. MALURUS MELANOTUS, *Gould.* Black-backed Superb Warbler.

Malurus melanotus, Gould, Birds of Austr., fol. ed., Vol. III, pl. 20 (1848); North, Nests and Eggs, Austr. Bds., p. 114, pl. XIII, fig. 19 (1889).

This species is only met with in the scrubby arid back country of the south-western portions of the Colony. In habits and mode of nidification it resembles *M. cyaneus* of the coast. Eggs, three or four in number for a sitting, white, spotted with rich red; length, 0·65 x 0·45 inch.

67. MALURUS LEUCOPTERUS, *Quoy et Gaimard.* White-winged Superb Warbler, "White-winged Wren."

Malurus leucopterus, Gould, Birds of Austr., fol. ed., Vol. III, pl. 25 (1848); North, Nests and Eggs of Austr. Bds., p. 116 (1889).

An inland species rather freely dispersed over the "Saltbush" (*Rhagodia*) covered plains of the central and south-western portions of the Colony. It is of a shy disposition and so feeble are its powers of flight that in dry seasons when the country is bare, it can easily be run down on horseback. The White-winged Superb Warbler constructs its dome-shaped nest in a low bush close to the ground. Eggs, four in number for a sitting, some being almost pure white or but finely freckled with pale reddish-brown, other specimens being blotched or zoned with light red on the larger end; length, 0·58 x 0·43 inch.

68. MALURUS LEUCONOTUS, *Gould.* White-backed Superb Warbler.

Malurus leuconotus, Gould, Suppl. Birds of Austr., pl. 24 (1869); North, Nests and Eggs Austr. Bds., p. 117 (1889).

The White-backed Superb Warbler is an extremely rare species, differing only from the preceding bird in having the back as well as the inner coverts and inner secondaries pure white. Only on one occasion has its occurrence been recorded in New South Wales, when it was found breeding near Bourke.

69. MALURUS CALLAINUS, *Gould.* Turquoisine Superb Warbler.

Malurus callainus, Gould, Suppl. Birds of Australia, pl. 23 (1869); North, Nests and Eggs Austr. Bds., p. 118, pl. xiii, fig. 18 (1889).

One of the most beautiful species of this interesting group of birds inhabiting New South Wales, and met with only in the dense scrubs in the central and western portions of the Colony. It builds a dome-shaped nest in a low bush or shrub, and lays three or four eggs, white, with dots, spots, and blotches of rich red; length, 0·67 x 0·48 inch. Like all the species of this genus, upon the Turquoisine Superb Warbler frequently devolves the duty of hatching the egg, and rearing the young of the Rufous-tailed Bronze Cuckoo (*Lamprococcyx basalis*).

70. MALURUS MELANOCEPHALUS, *Vigors and Horsfield.* Black-headed Warbler, "Scarlet-backed Superb Warbler."

Malurus melanocephalus, Gould, Birds of Austr., fol. ed. Vol. iii, pl. 26 (1848); North, Nests and Eggs Austr. Bds., p. 117 (1889).

The Scarlet-backed Superb Warbler is freely dispersed throughout the rich brushes of the northern coastal rivers, and the grassy gullies and valleys of their watershed. The nest is similar to that of *M. cyaneus*, and is usually built in a tuft of long grass. Eggs, three in number for a sitting, white, spotted, and minutely freckled, or dotted with rich red; length, 0·62 x 0·43

PL. XI.

MALURUS MELANOCEPHALUS, Vig. & Horsf.

Black-headed Superb Warbler.

MALURUS CYANEUS, Ellis.

Superb Warbler.

inch. All the members of this genus are strictly insectivorous, but with the exception of *M. cyaneus*, *M. lamberti*, and the present species, they are only met with on the large pastoral areas in the interior of the Colony. The figure represents an adult male.

71. MENURA SUPERBA, *Davies*. Lyre-bird, "Native Pheasant."

Menura superba, Gould, Birds of Austr., fol. ed., Vol. III, pl. 14 (1848); North, Nests and Eggs of Austr. Bds., p. 119, pl. X, fig. 4 (1889).

Inhabits the brushes of the coast, but is far more freely dispersed throughout the dense undergrowth that clothes the sides of our mountain ranges, particularly those in the south-eastern portion of the Colony. This bird is of a shy and retiring disposition, and although known by its rich and varied notes to most residents living in the localities which it frequents, it is more often heard than seen. It breeds in June, July, and August, constructing a large oval-shaped nest of sticks, twigs, ferns, and mosses, having an entrance in the side, and lined with rootlets and the downy feathers from the flanks of the parent bird. The nest is usually placed on or near the ground at the foot of some stump, or between the stems of two small trees growing near one another. Sometimes it is built upon a ledge of rock, and not unfrequently in the thick bushy top of a tree-fern. Only one egg is laid for a sitting, varying in ground colour from slaty-grey to blackish or purplish-brown, and having spots and blotches of a deeper hue distributed over the surface of the shell; length, 2·45 x 1·65 inch. With the exception of small molluscs and terrestrial crustacea obtained chiefly under fallen leaves, the food of the Lyre-bird consists of insects. It is, however, too cautious to venture upon cleared lands or into orchards in search of them.

72. MENURA ALBERTI, *Gould*. Prince Albert's Lyre-bird.

Menura alberti, Gould, Birds of Austr., suppl., pl. 19 (1869); North, Nests and Eggs Austr. Bds., p. 122, pl. X., fig. 4 (1889).

A rarer species, and the tail feathers not so long as in *M. superba*, but which it resembles in habits and in its mode of nidification. It frequents the mountain ranges and dense brushes of the northern coastal districts lying between the Clarence and Tweed Rivers. The egg is slightly smaller than that of the preceding species.

73. AMYTIS STRIATUS, *Gould*. Striated Wren.

Amytis striatus, Gould, Birds of Austr., fol. ed., Vol. III, pl. 29 (1848); North, Nests and Eggs Austr. Bds., p. 123, pl. IX, fig. X (1889).

This species is an inhabitant of the mallee scrubs and those large areas covered with a dense growth of Porcupine grass (*Triodia irritans*) in the central and western portions of the Colony. The nest of the Striated Wren, which is built upon the ground, under the shelter of a bush or in a tuft of grass, is a partially-domed structure composed of bark fibre and the dried blades or spines of the Porcupine grass. Eggs, three in number for a sitting, white, thickly freckled and spotted with rich red; length, 0·85 x 0·65 inch.

74. AMYTIS TEXTILIS, *Quoy et Gaimard*. Rufous-flanked Wren.

Amytis textilis, Gould, Birds of Austr., fol. ed., Vol. III, pl. 28 (1848).

A common West and Central Australian species, but extremely rare in New South Wales. Gould, who visited Australia in 1838-9, states he found it very abundant on the Lower Namoi; but I did not meet with it during a collecting-trip made there in November, 1896.

75. STIPITURUS MALACURUS, *Latham.* Emu Wren.

Stipiturus malachurus, Gould, Birds Austr., fol. ed., Vol. III, pl. 31 (1848); North, Nests and Eggs of Austr. Bds., p. 124 (1889).

A resident species evincing a decided preference for marshy districts covered with rushes near the coast; and less sparingly distributed throughout the low contiguous scrubby undergrowth. The nest which is nearly spherical in form with an entrance in the side, is usually built under the shelter of a tuft of rank grass or overhanging rushes; it is constructed of grasses and rootlets, and is lined with feathers, mosses, or other soft and warm materials. Eggs, three in number, for a sitting, white, sprinkled over with minute dots and spots of light reddish-brown; length, 0·64 x 0·5 inch. This bird is strictly insectivorous, but it is seldom seen on cultivated lands.

76. HYLACOLA PYRRHOPYGIA. Red-rumped Wren, "Scrub Wren."

Hylacola pyrrhopygia, Gould, Bds. of Austr., fol. ed., Vol. III, pl. 39 (1848); North, Nest and Eggs of Austr. Birds, p. 127 (1889).

This species is sparingly distributed in favourable situations over most parts of the Colony. It frequents low scrubby undergrowth, and more particularly those portions in which the *Epacris* and stunted *Banksia* abound. Near Hornsby and Thornleigh on the northern line it may be met with in the bush, but it seldom ventures into the neighbouring orchards. The nest of the Red-rumped Wren is a dome-shaped structure with a narrow protruding entrance in the side, and is composed of strips of bark, grasses, and wiry rootlets, slightly lined inside with feathers or other soft material; it is usually built in a thick bush within a few inches of the ground. Eggs, two or three in number for a sitting, varying in ground colour from a warm pinky-white which becomes darker at the larger end, to a light clove brown; the surface of the shell being sparingly marked with different shades of chocolate-brown, but predominating as usual towards the thicker end. Some specimens are entirely free from markings, but usually the ground colour is much darker on the thicker end; length, 0·77 x 0·58 inch.

77. ATRICHIA RUFESCENS, *Ramsay.* Rufous Scrub-bird.

Atrichia rufescens, Gould, Suppl. Birds, Austr., fol. ed., pl. 26 (1869).

A rare species inhabiting the dense brushes of the Richmond River. This bird is a perfect mimic and ventriloquist, and may be heard imitating the notes of many species frequenting the same situations, but seldom exposes itself to view. Its food consists of insects, which are procured chiefly among fallen and decaying timber. Nothing is known of its nidification, and its nest and eggs would be a welcome addition to the Museum collection.

78. PYCNOPTILUS FLOCCOSUS, *Gould*, Downy Pycnoptilus, "Pilot-bird."

Pycnoptilus floccosus, Gould, Suppl. Bds., Austr., fol. ed., pl. 27 (1869); North, Nests and Eggs of Austr. Bds., p. 128, pl. 9, fig. 6 (1889).

This species is an inhabitant of the thick undergrowth of the humid gullies and ranges of the Illawarra district, and the scrubs that clothe the sides of the Blue Mountains. It passes most of its time upon the ground hopping about the tangled masses of luxuriant vegetation or among the fallen and decaying timber in search of insects and seeds of various kinds, which constitute its food, stopping ever and anon to pour forth its rich and clear notes which can be heard a considerable distance away. Although never

frequenting cultivated lands or orchards it is by no means a shy species, and will often venture on to the side of a mountain track in search of food if one is only a few feet away, and remains perfectly still. The nest is a dome-shaped structure with an entrance in the side, and is composed of strips of bark and rootlets, lined inside with feathers; it is usually built in the thick undergrowth near the ground. Eggs, two in number for a sitting, of a slaty or purplish-brown ground colour, with a zone of indistinct blackish markings on the thicker end; length, 1 x 0·75 inch.

79. CISTICOLA EXILIS, *Vigors* and *Horsfield.* Grass Warbler, "Corn-bird," "Barley-bird."

Cysticola exilis, Gould, Bds. Austr., fol. ed., Vol. III, pl. 42 (1848).

Cysticola lineocapilla, Gould, Bds. Austr., fol. ed., Vol. III, pl. 43 (1848).

Cysticola isura, Gould, Bds. Austr., fol. ed., Vol. III, pl. 44 (1848).

Cysticola ruficeps, Gould, Bds. Austr., fol. ed., Vol. III, pl. 45 (1848).

The above synonymy has been worked out by Dr. R. B. Sharpe in the seventh volume of the catalogue of birds in the British Museum, p. 269, after a careful examination of a large series of specimens, and who has conclusively proved that the four plates figured in Gould's work, and referred to above, are only sexual and seasonal variations of the present species, *C. exilis*; and specimens shot in the neighbourhood of Sydney sustain Dr. Sharpe's determination. This little bird has a most extensive range, being found in favourable situations all over Australia, the Papuan and Moluccan Islands, the Phillipines and South-eastern Asia. In New South Wales it is more frequently met with in the grass beds near the coast; and in cultivated parts of the Colony, the standing grain crops. The nest is usually built near the ground upon three or four grass stalks growing through some broad-leaved plant; when built in crops, frequently a thistle. It is a neat dome-shaped structure, formed of thistledown, fine grasses, and the dead flowering portions of grass stems beautifully woven together, and usually almost concealed by two or three of the surrounding leaves being worked on to the sides of the nest. Eggs, three or four in number for a sitting, blue, spotted or blotched, particularly at the larger end, with brownish-red. The food of this bird consists exclusively of minute insects. From its habits of building in standing crops in agricultural districts it is known in some parts of the Colony under the local name of "Corn" or "Barley-bird."

80. SERICORNIS CITREOGULARIS, *Gould.* Yellow-throated Sericornis.

Sericornis citreogularis, Gould, Birds of Austr., fol. ed., pl. 46 (1868). North, Nests and Eggs of Austr. Bds., p. 129, pl. 9, fig. 5 (1889).

This species is freely dispersed throughout the rich coastal brushes of the Colony. It is common in the luxuriant undergrowth that clothes the sides of the Richmond and Clarence Rivers, and the humid gullies of the Illawarra District. The nest of this species is a large, pendent, dome-shaped structure, composed of rootlets and mosses, with a narrow entrance in the side, and is usually attached to the end of a drooping branch. Eggs, three in number for a sitting, of a pale chocolate-brown or uniform drab ground colour, minutely freckled at the larger end with blackish-brown, forming a well-defined zone; length, 0·95 x 0·68 inch. The food of this genus of birds, which consists of insects of various kinds, is chiefly obtained on the ground, among the fallen timber or débris in the low undergrowth, but they seldom venture on to cleared or cultivated lands.

81. Sericornis magnirostris, *Gould*. Large-billed Sericornis.

Sericornis magnirostris, Gould, Birds Austr., fol. ed., Vol. III, pl. 52 (1848); North, Nests and Eggs Austr. Bds., p. 132 (1889).

A smaller species, frequenting the same situations as the Yellow-throated Sericornis, and which it resembles in habits and mode of nidification. Eggs, three or four in number for a sitting, of a faint purplish-white ground colour, indistinctly spotted with dark-brown, the markings usually being confined to the larger end of the egg, and forming a confluent patch or well-defined zone; length, 0·77 x 0·58 inch. The Large-billed Sericornis is frequently the foster-parent of the Fan-tailed Cuckoo (*Cacomantis flabelliformis*).

82. Sericornis frontalis, *Vigors* and *Horsfield*. White-fronted Sericornis.

Sericornis frontalis, Gould, Birds Austr., fol. ed., Vol. III, pl. 49 (1848); North, Nests and Eggs Austr. Bds., p. 131, pl. 9, fig. 16 (1889).

This is the most common species of the genus in New South Wales, inhabiting not only the coastal brushes, like *S. citreogularis* and *S. magnirostris*, but also the scrubby undergrowth of the mountain ranges inland. The nest is a dome-shaped structure, with a narrow entrance in the side; it is outwardly composed of leaves, dried portions of fern fronds, and wiry rootlets, and lined inside with feathers or hair. Usually it is well-concealed at the bottom of a scrubby bush, or under the shelter of a tuft of grass. Sometimes it is placed in the dead, leafy top of a fallen sapling, or in a clump of low ferns. Eggs, three in number for a sitting, of a faint purplish-brown ground colour, with a well-defined zone of dark purplish-brown markings on the larger end; length, 0·78 x 0·6 inch. This species commences to breed in August, and continues the four following months.

83. Sericornis maculatus, *Gould*. Spotted Sericornis.

Sericornis maculatus, Gould, Birds of Austr., fol. ed., Vol. III, pl. 51 (1848); North, Nests and Eggs Austr. Bds., p. 133.

The scrubs of the south-western portion of the Colony are the only places in New South Wales this species is met with. In habits and mode of nidification it resembles the preceding species. Eggs, three in number for a sitting, of a fleshy-white ground colour, freckled and spotted with dark purplish and slaty-grey markings, which predominate as usual towards the larger end; length, 0·78 x 0·54 inch.

84. Pyrrholæmus brunnea, *Gould*. Red-Throat.

Pyrrholæmus brunneus, Gould, Birds of Austr., fol. ed., Vol. III, pl. 68 (1848); North, Nests and Eggs of Austr. Bds., p. 145, pl. IX, fig. 15, (1889).

The Red-Throat inhabits the arid scrubs of the central and south-western portions of the Colony, but where it is by no means numerous. The nest, which is usually placed in a low bush near the ground, is spherical in form, with a small hole in the side, and is composed of soft dried grasses, lined inside with feathers or fur. Eggs, three or four in number for a sitting, of a uniform olivaceous-brown, chocolate-brown, or bronze tint, some specimens having an indistinct zone or cap on the larger end. The food of the Red-Throat consists exclusively of insects.

PL. XII.

ACANTHIZA NANA, VIG. & HORSF.
YELLOW ACANTHIZA.

GEOBASILEUS CHRYSORRHOA, QUOY ET GAIM.
YELLOW-RUMPED GEOBASILEUS.

85. ACANTHIZA PUSILLA, *Latham.* Little Brown Acanthiza, "Tomtit."

Acanthiza pusilla, Gould, Birds of Austr., fol. ed., Vol. III, pl. 53 (1848); North, Nests and Eggs of Austr. Bds., p. 133 (1889).

The species belonging to the closely allied genera, *Acanthiza* and *Geobasileus*, found in New South Wales, are well known to most residents of the Colony under the local names of "Tomtits" and "Dickies," which are bestowed on all members of these genera. Being strictly insectivorous, and frequenting orchards and gardens in search of food, they are most useful little birds. The present species, *A. pusilla*, is more often met with in the scrubby undergrowth near the coast than inland. It commences to breed in July, constructing a dome-shaped nest of strips of bark and grasses, lined inside with the white down from the seed-pods of the introduced "Cotton Plant" (*Gomphocarpus fruticosus*) and feathers. The nest is usually built near the ground, and frequently in the low fern (*Pteris aquilina*). Eggs, three in number for a sitting, pure white, finely freckled with dull reddish-brown on the thicker end, where in some instances the markings assume the form of a zone; length, 0·66 x 0·49 inch.

86. ACANTHIZA LINEATA, *Gould.* Lineated Acanthiza, "Striped-headed Tomtit."

Acanthiza lineata, Gould, Birds of Austr., fol. ed., Vol. III, pl. 61 (1848); North, Nests and Eggs of Austr. Bds., p. 138 (1889).

The Lineated Acanthiza is frequently met with in the same localities as the preceding species, but it is more freely dispersed throughout the low gum saplings that clothe the sides of our mountain ranges than the scrubby undergrowth near the coast. The nest of this species, which is usually built among the leafy twigs of a gum sapling, is a neat dome-shaped structure, with a protecting hood sheltering the narrow entrance near the top; it is composed of bark fibre closely interwoven, and ornamented on the outside with spiders' nests or the white paper-like bark of the *Melaleuca*, and warmly lined with feathers or opossum-fur. Eggs, three in number for a sitting, elongate in form, of a pinky-white ground colour, distinctly zoned on the larger end with brownish-red markings; length, 0·7 x 0·5 inch. From its habit of building a pendent nest, this bird is known locally by bird-nesting boys in the neighbourhood of Sydney as the "Hanging Dicky."

87. ACANTHIZA NANA, *Vigors and Horsfield.* Little Yellow Acanthiza, "Yellow Tomtit."

Acanthiza nana, Gould, Birds of Austr., fol. ed., Vol. III, pl. 60 (1848); North, Nests and Eggs of Austr. Bds., p. 137, pl. XIII, fig. 16 (1889).

This species is freely dispersed throughout the eastern portions of the Colony. Near the coast it may be constantly met with in the light undergrowth, or among the *Casuarinæ* and *Eucalypti*, diligently searching for minute insects which constitute its food. The nest is built in the topmost twigs of a low tree, usually a *Melaleuca* or gum sapling, and not unfrequently at the extremity of a bushy bough of the acclimatised *Pinus insignus;* it is a dome-shaped structure with a narrow entrance near the top, and is composed of bark fibre and grasses, ornamented on the outside

with spiders' bags or fine green mosses, and warmly lined with finer grasses, feathers, or the silky down from the seed-pods of the "Cotton Plant." Eggs, three in number for a sitting, white, with longitudinal blotches and freckles of dull reddish or chocolate-brown uniformly dispersed over the surface of the shell; length, 0·65 x 0·45 inch. All the species of *Acanthizæ* inhabiting New South Wales are frequently the foster-parents of the Fan-tailed and Bronze Cuckoos. The specimen from which the figure is taken is a male, but the sexes are alike in plumage. This species is also known locally in the neighbourhood of Sydney as the "Little Hanger" or "Little Hanging Dicky."

88. Acanthiza uropygialis, *Gould.* Chestnut-rumped Acanthiza.

Acanthiza uropygialis, Gould, Birds of Austr., fol. ed., Vol. III, pl. 56 (1848); North, Nests and Eggs of Austr. Bds., p. 135 (1889).

This species inhabits the scrubby portions of the central and western districts of the Colony. Its nest, which is built in the hollow limb or trunk of some small tree, or firmly wedged between the upright stems of two trees growing close to each other, is dome-shaped, and composed of soft dried grasses and bark-fibre neatly lined with feathers and fur. Eggs, three in number for a sitting, of a delicate fleshy-white, minutely freckled all over with light reddish-brown markings; length, 0·65 x 0·48 inch.

89. Geobasileus chrysorrhoa, *Quoy et Gaimard.* Yellow-rumped Geobasileus, "Yellow-tail," "Tomtit," "Double Dick."

Acanthiza chrysorrhœa, Gould, Birds of Austr., fol. ed., Vol. III, pl. 63 (1848).

Geobasileus chrysorrhœa, North, Nests and Eggs of Austr. Bds., p. 141 (1889).

A common and well-known species found all over New South Wales. It frequents gardens and orchards, and is exceedingly useful in ridding the trees of many insect pests. The normal breeding season of this bird commences in July and continues until the end of December, but nests are sometimes found containing eggs or young ones during February and March. The nest is usually built in the bushy end of a drooping bough or in a thick shrub, and in gardens, frequently in orange-trees, prickly hedges, and the acclimatised pines, *Araucaria excelsa* and *Pinus insignus.* It is a roughly-formed dome-shaped structure, with a narrow entrance in the side, and is composed of dried grasses, strips of bark, wool, cobwebs, the flowering portions of grasses all matted up together, and lined inside with finer grasses and feathers. On the top of the nest is a small cup-shaped depression without any lining, which is used by the male bird as a roosting-place. Eggs, three in number for a sitting, pure white, but occasionally they are found with minute dots and spots of reddish and yellowish brown sparingly distributed over the surface of the shell; length, 0·68 x 0·5 inch. This species more often than any other bird is the foster-parent of the Bronze Cuckoo, (*Lamprococcyx plagosus.*) The open cup-shaped depression or second nest on the top of the lower structure is not so symmetrically formed as figured in Gould's work. From this bird's habit of building an open nest on the top of the domed one, it is known locally in the neighbourhood of Sydney as the "Double Dick."

PL. XIII.

EPHTHIANURA AURIFRONS, Gould.
Orange-fronted Ephthianura.

EPHTHIANURA ALBIFRONS, Jard. & Selby.
White-fronted Ephthianura.

90. Geobasileus reguloides, *Vigors and Horsfield.* Buff-rumped Geobasileus.

Acanthiza reguloides, Gould, Birds of Austr., fol. ed., Vol. III, pl. 62 (1848).

Geobasileus reguloides, North, Nests and Eggs Austr. Bds., p. 140 (1889).

The Buff-rumped Geobasileus is often found in the same localities as the preceding species, and is distributed over most parts of the Colony. It is usually met with in autumn and winter in small flocks of from seven to ten in number, busily engaged in searching for insects in the grassy glades of the lightly-timbered undergrowth near the coast, or open forest country inland. The nest of this species, which is usually built in the forked trunk of a tree, and hidden by strips of bark, or under an overhanging bank, is a dome-shaped structure, composed of strips of bark and grasses, lined inside with feathers, opossum-fur, or the silky down from the seed-pods of the "Cotton Plant." Frequently, too, the nest is placed in the mortise-hole of a post, or at the bottom of a low shrub. Eggs, three or four in number for a sitting, of a delicate white ground colour, freckled and spotted on the thicker end with different shades of reddish and purplish brown, which in most instances become confluent and assume the form of a zone; length, 0·67 x 0·47 inch. This species is not uncommon in the orchards near Eastwood, and where I saw several feeding a young Fan-tailed Cuckooo on the 1st of January.

91. Ephthianura albifrons, *Jardine and Selby.* White-fronted Ephthianura.

Ephthianura albifrons, Gould, Birds of Austr., fol. ed., Vol. III, pl. 64 (1848); North, Nests and Eggs of Austr. Bds., p. 144, pl. XIII, fig. 11 (1889).

A resident species, frequently met with during spring and summer in marshy localities, or among low ferns on the sand-covered wastes near the coast, and on the open plains and partially-cleared country inland. The nest of this bird is usually built in a tuft of rushes, or in a low bush near the ground; it is an open, cup-shaped structure, outwardly composed of very fine twigs or coarse grasses, and neatly lined inside with finer grasses and hair. Eggs, three or four in number for a sitting, pure white, sparingly spotted and dotted or irregularly marked with rich reddish-brown; length, 0·67 x 0·48 inch. The food of this species, like the other members of the genus *Ephthianura*, consists principally of caterpillars and soft-bodied insects. The figure represents a male. August and the two following months constitute the usual breeding season, but nests containing fresh eggs have been found during March and April near Sydney.

92. Ephthianura aurifrons, *Gould.* Orange-fronted Ephthianura.

Ephthianura aurifrons, Gould, Birds of Austr., fol. ed., Vol. III, pl. 65 (1848); North, Nests and Eggs of Austr. Bds., p. 144 (1889).

A plain-frequenting species, inhabiting the central and western districts of the Colony. It is usually met with in small flocks of from ten to twenty individuals, the brilliant orange-coloured plumage of the male frequently attracting one's attention when travelling over those wide expanses in which the "Cotton Bush" (*Kochia aphylla*) and "Salt Bush" (*Rhagodia parabolica*) abound. The nest of the Yellow-fronted Ephthianura is usually

built in a low bush near the ground, and although slightly smaller, in other respects closely resembles that of the preceding species. Eggs, three in number, white, spotted and dotted with rich red; length, 0·63 x 0·49 inch. The figure represents a male.

93. EPHTHIANURA TRICOLOR, *Gould.* Crimson-fronted Ephthianura.

Ephthianura tricolor, Gould, Birds of Austr., fol. ed., Vol. III, pl. 66 (1848); North, Nests and Eggs of Austr. Bds., p. 143, pl. XIII, fig. 12 (1889).

A migratory species arriving in the inland portions of the Colony in October, and departing again at the end of January. It frequents scrub or timbered lands, on the outskirts of which it builds its nest in some low bush or tuft of grass near the ground. Eggs white, spotted and dotted with dark red; length, 0·63 x 0·51 inch. The plumage of the adult male is even more conspicuous than that of the Orange-fronted Ephthianura.

94. ORIGMA RUBRICATA, *Latham.* Rock Warbler, "Cave-bird."

Origma rubricata, Gould, Birds of Austr., fol. ed., Vol. III, pl. 69 (1848); North, Nest and Eggs Austr. Bds., p. 142, pl. XIII, fig. 8 (1889).

Although sparingly distributed over Eastern New South Wales, the Rock Warbler is more often met with in that portion of the colony lying between the Manning and Shoalhaven Rivers, frequenting the rocky sides of rivers and gullies near the coast, and the ravines of the mountain ranges inland. It is strictly insectivorous, and obtains its food upon the ground among rocks or débris, but is too shy to enter the gardens of settlers. The nest of this species is oval in form with an entrance in the side, and is composed of fibrous roots lined inside with feathers; it is usually suspended to the roof of a small cave or overhanging rock; but not unfrequently it is built in a disused coal-pit. Eggs, pure white, and three in number for a setting; length, 0·8 x 0·6 inch.

The members of the following genera, *Xerophila*, *Chthonicola*, *Anthus*, *Cincloramphus*, and *Mirafra* I have included in this list, although they are not exclusively insectivorous, their food consisting to a certain extent also of the seeds of various grasses, but they do no harm, and all are exceedingly useful birds to the agriculturist.

95. XEROPHILA LEUCOPSIS, *Gould.* White-faced Xerophila, "Squeaker."

Xerophila leucopsis, Gould, Birds of Austr., fol. ed., Vol. III, pl. 67 (1848); North, Nests and Eggs Austr. Bds., p. 150, pl. IX, fig. 14 (1889).

This species is freely dispersed throughout the inland districts of the Colony. It is usually met with both on the plains and in timbered country in small flocks numbering from eight to twenty individuals, and almost always on the ground, searching for the seeds of various grasses or insects, which constitute its food. The nest, which is a rather large domed structure, composed of strips of bark and grasses, lined inside with feathers or hair, is usually placed in the hollow limb or trunk of a small tree, and occasionally at the bottom of a thick shrub; at other times it is placed in the mortise-hole of a post or in the interstices beneath the nest of the Wedge-tailed Eagle. The eggs are four or five in number for a sitting, of a dull white,

thickly freckled and spotted with different shades of reddish and chocolate brown, some specimens having underlying spots of deep bluish-grey, in others the markings being confined to the larger end, and forming a well-defined zone; length, 0·72 x 0·55 inch.

96. CHTHONICOLA SAGITTATA, *Latham.* "Speckled Ground Lark."

Chthonicola minima, Gould, Birds Austr., fol. ed., Vol. III, pl. 72 (1848).

Chthonicola sagittata, North, Nests and Eggs Austr. Bds., p. 149 (1889).

This is a resident species, and with the exception of the western portions of the Colony, is found in most parts of New South Wales. It passes most of its time on the ground, and is usually met with in open forest country, especially where the *Casurinæ* abound, or in the grassy glades of the lightly-timbered undergrowth near the coast. The nest of this species is a domed-shaped structure, built underneath or at the side of a tuft of overhanging grass, and is constructed throughout of dried grasses, and lined with fur or a few feathers at the bottom. Eggs, three or four in number for a sitting, of a uniform bright chocolate red, and easily distinguished by the depth and intensity of their colouring from those of any other Australian bird; length, 0·76 x 0·6 inch. The Speckled Ground Lark commences to breed in August, and continues the four following months. Frequently this species is the foster-parent of the Fan-tailed Cuckoo (*Cacomantis flabelliformis*).

97. ANTHUS AUSTRALIS, *Vigors and Horsfield.* Australian Pipit, "Common Ground Lark."

Anthus australis, Gould, Birds Austr., fol. ed., Vol. III, pl. 73 (1848); North, Nests and Eggs Austr. Bds., p. 158 (1889).

A well-known and useful species, found all over Australia. It is common on grassy plains, partially-cleared lands, and cultivation paddocks. The nest of this bird is formed in a hollow scraped in the ground, usually under some overhanging tuft of grass or among low rushes. Eggs, three in number for a sitting, of a dull, white ground colour, which is almost obscured with freckles of slaty-brown, umber-brown, and ashy-grey; length, 0·86 x 0·65 inch. The food of this species consists of insects and small seeds, principally the former. The sexes are alike in plumage.

98. CINCLORAMPHUS CRURALIS, *Vigors and Horsfield.* "Brown Skylark."

Cincloramphus cruralis, Gould, Birds of Austr., fol. ed., Vol. III, pl. 74 (1848); North, Nests and Eggs Austr. Bds., p. 152 (1889).

A migratory species, arriving in New South Wales about August, and departing again at the end of February. Its appearance, however, is greatly influenced by the state of the seasons, for in periods of drought it is seldom seen, while after an abundant rainfall, and when the paddocks are clothed with luxuriant grasses and herbage, it is often met with. It breeds in September and October, constructing a nest of dried grasses in a slight hollow in the ground, and usually sheltered by a tuft of long grass. The eggs are four in number for a sitting, of a dull white ground colour, which is almost obscured by very fine isabelline or salmon-coloured freckles and spots; in some instances zones of indistinct markings appear on the thicker end; length, 0·95 x 0·7 inch. This bird is possessed of powers of ventriloquism in addition to its loud and pleasing song. It is more frequently met with in the inland districts of the Colony than near the coast.

99. Cincloramphus rufescens, *Vigors and Horsfield.* "Rufous-rumped Skylark," "Singing Lark."

Cincloramphus rufescens, Gould, Birds Austr., fol. ed., Vol. III, pl. 76 (1848); North, Nests and Eggs Austr. Bds., p. 153 (1889).

The Rufous-rumped Skylark is a smaller species than the preceding one, but precisely similar in habits, and in the times of its arrival and departure from New South Wales. The nest is cup-shaped, and is composed of dried grasses lined with hair; it is usually built in a hollow scraped in the earth at the side of a tuft of grass, or hidden by the dead leafy twigs of a fallen tree. Eggs, three or four in number for a sitting, and subject to considerable variation, the most usual variety found being of a purplish white ground colour, thickly freckled and spotted with reddish-chestnut, chestnut, and purplish-brown markings; length, 0·84 x 0·62 inch.

100. Mirafra horsfieldii, *Gould.* Horsfield's Bush Lark, "Thick-billed Lark."

Mirafra horsfieldi, Gould, Birds of Austr., fol. ed., Vol. III, pl. 77 (1848); North, Nests and Eggs Austr. Bds., p. 159 (1889).

The present species frequents open grassy flats, low heath grounds, and cultivation paddocks. When disturbed it only flies a few yards with a peculiar jerky flight, and then suddenly drops into concealment again. It is one of our most pleasing songsters, and may be often heard singing at night while flying slowly about high in the air, and more especially on bright moonlight nights about midsummer.

The Thick-billed Lark breeds during January and February, constructing a partially-domed nest of dried grasses in a slight hollow in the ground, sheltered by a tuft of grass, or by the surrounding crop when built in cultivation paddocks. Eggs, three in number for a sitting, closely resembling small specimens of those of *Anthus australis;* length, 0·78 x 0·5 inch. The sexes are alike in plumage.

101. Megalurus galactotes, *Temminck.* Tawny Grass-bird.

Sphenœacus galactotes, Gould, Birds of Austr., fol. ed., Vol. III, pl. 35 (1848).

Megalurus galactotes, North, Proc. Linn. Soc., N.S.W., Vol. x, 2nd Series, p. 217 (1895).

A rare species, seldom met with except in the north-eastern portions of the Colony.

102. Megalurus gramineus, *Gould.* Little Grass-bird.

Sphenœacus gramineus, Gould, Birds of Austr., fol. ed., Vol. III, pl. 36 (1848).

Megalurus gramineus, North, Nests and Eggs Austr. Birds, p. 146 (1889).

The Little Grass-bird is dispersed in favourable situations over most parts of New South Wales. It frequents dense grass-beds growing in swampy localities, the rush or reed lined margins of watercourses, and, near the coast, the mangrove-fringed estuaries or sides of rivers. The nest of this species, which is a deep cup-shaped structure, is composed of dried aquatic plants, coarse grasses, or fibrous roots lined inside with feathers, the entrance at the top being slightly narrowed or domed, and is usually placed at the bottom of a tuft of rushes, or on the forked, upright, leafy stems of a mangrove. Eggs, four in number for a sitting, of a reddish-white ground

PL. XIV.

MIRAFRA HORSFIELDI, Gould.
Horsfield's Bush Lark.

ANTHUS AUSTRALIS, Vig. & Horsf.
Australian Pipit.

colour, finely freckled all over with purplish-red or reddish-brown markings; length, 0·76 x 0·53 inch. This species is extremely shy, and it is seldom possible to get a glimpse of it, except when it flies over a clear expanse of water from one clump of rushes to another. In summer its plaintive note may be heard during the night.

103. Acrocephalus australis, *Gould.* "Reed Warbler."

Acrocephalus australis, Gould, Birds of Austr., fol. ed., Vol. III, pl. 37 (1848); North, Nests and Eggs Austr. Birds, p. 169.

A migratory species, arriving in New South Wales about the end of September, and departing again in March. It frequents the reedy margins of rivers and lagoons, and is freely dispersed over most parts of the Colony. The nest of the Reed Warbler is usually built between two or three upright reeds growing in the water. It is a deep cup-shaped structure, outwardly composed of the soft, paper-like sheaths of reeds and decaying water-weeds, and lined inside with grasses, sometimes a few feathers being worked into the bottom of the nest. Eggs, three or four in number for a sitting, of a greyish-white ground colour, spotted and blotched all over with different shades of yellowish-brown, blackish-brown, and underlying markings of deep violet-grey; length, 0·8 x 0·55 inch. The breeding season commences in October, and lasts until the end of January. Not unfrequently this bird resorts to gardens, especially those containing a reed-fringed creek or water-hole. Like the preceding species, the cheerful notes of the Reed Warbler may be frequently heard during the night.

(To be continued.)

Report on the Murray and Hunter River Vine Districts.

M. BLUNNO,
Acting Viticulturist.

Murray River District.

I AM much impressed with what I have seen, and consider that there is a great future for the wine-growing industry. The wine-growers received me with great courtesy, allowed me to taste their whole stocks, and seemed anxious to profit by any suggestions that I could make. I anticipate no failure can be feared where natural factors—climate and soil (against which it is very hard to fight), agree wonderfully for producing certain types of wine, and I say certain types of wine in a restrictive way—as it would be impossible to produce wines in this district partaking of the light delicate types produced in many parts of the continent.

I have tasted many wines, both in the small and large cellars, and my impression has been always the same—any efforts to produce a similar wine to Hock or Claret have been crowned with only partial success.

Wines produced in these districts contain some elements in excess, as alcohol, tannic acid, coloring matter, extractive substances; therefore wines that are wanting in harmony of the chemical composition, which harmony is essential for table wines, so they rather come in the category of blending wines. But I am pleased to say they are blending wines of the first quality, because generally they are made from grapes which, in cool climates, as the centre of France, give very good table wines. Thus they would blend more kindly than some wines grown in many parts of Europe, which are used for blending, as they are of a superior species of grape.

The work of blending these wines with a light wine, richer in total acidity, and more delicate, is easier than that which is necessary in manipulating certain blending wines of other countries of the world, which need great patience and perseverance to produce wines which are harmonic and kind. Even the earthy taste, which is very hard to eradicate in blending, is not so accentuated, and I am convinced that the fermentation in small vats, which is here generally adopted, has the faculty of getting rid of it.

However, experts have not as yet ascertained the cause of this earthy flavour. There are some who ascribe it to the formation of an organic compound, viz., etilmercaptan*; some who believe it to be due to a special

* The etilmercaptan, the smell of which has not the slightest affinity with the earthy taste, is maintained but by few as the cause of it.

characteristic of certain kinds of grapes, while others think that it occurs when the bunches of grapes are grown too close to the soil. As far as I am concerned, I am of opinion that at least one of the first causes is the fermentation at too high a temperature; in fact, the earthy taste is not so common in France with the same kind of grape.

I expected to have found a greater quantity of wines affected by that dreadful disease, viz., lactic acid, from lactic fermentation, so frequent in hot climates, but also from this point of view the reality has been less than my expectations. Last vintage has been made under favourable conditions, for a period of rainfall has kept a lower temperature, but the old wines, too, I have found without it. In fact, vignerons here are very well informed about the influence of the high temperature on fermentation. Wisely they use small vats, and therefore avoid that excessive temperature where the lactic ferment takes predominance. Some vignerons are now using cement vats of small size, and which have a great advantage over those of wood of the same size, for the heat developed in fermenting wines is more easily expelled.

The natural conditions here also produce wines of a dessert type, either dry or sweet (*vins de liqueurs*), and vignerons know that, and say themselves that white wines, not only when made with Pedro Ximenes, but even when made from Riesling, Tokay, and Aucarot, develop a sherry type when aged. And I believe that the making of these types of wines for export will in time become a profitable industry.

With very few exceptions proper cellars have not been erected. Simple sheds of corrugated iron, both for walls and roofs, are generally thought sufficient. In these the temperature is very unfavourable for keeping sound those wines containing less than 28 per cent. of proof spirit, while it is very favourable for maturing wines with an alcoholic strength of over 28 per cent., as then we have to deal with dessert wines, either dry or sweet, which mature more quickly in hot than cool cellars; in fact, all stocks in Spain, Portugal, Madeira, and Sicily, where the best dessert wines are made, are kept in but simple sheds, where they are subject to all changes of weather without harm, as they are protected by a good proportion of alcohol, which, being above 28 per cent., paralyzes the power of every germ of disease; but such hot stores are a great trouble for regulating the temperature of the fermenting musts in such a way that fermentation be pure and complete. About two-fifths of the wine-growing countries of the world have to fight against the too high temperature, which, if not satisfactorily dominated, will destroy the bulk of the wine, turning it into a nauseous article, unfit for consumption.

The Iberic Peninsular, Southern Italy, Sicily, Algeria, South Australia, parts of Victoria, and of California, as well as the wine-growing districts of South America are all subject to the great inconvenience, that is to say, high initial temperature of the must before fermentation commences, which rapidly attains 95° F., at which first the ferment of vinegar, and later on that of lactic acid takes dominion, while the vinous fermentation is checked, there still existing a percentage of undecomposed sugar. Scientists have for many years made laborious researches in endeavouring to find the best way of expelling the heat developed by the physiological work of the yeast in decomposing the sugar, and several ways have been pointed out, some of which are easy, cheap, and in the reach of small wine-makers. In fact, in my visit I saw some machinery, or rather tools, that are well suited to the wine, nevertheless a proper uncontested system of cooling must, suitable for

regulating temperature in big vats, as required from the economical standpoint in big wineries, has not yet been found, or at least has not as yet received general sanction.*

My first visit being after the winter and beginning of spring, the first thing that received my attention was the systems of pruning. Vignerons, in some instances, of both the Albury and Corowa districts have not an exact idea of the different systems of pruning, except the summary idea of long pruning, short pruning, and trellis; and I saw some vineyards pruned in such a way that I could not tell what kind of system it belonged to. Nevertheless, I am pleased to say that often I could see the skilled hand and the common-sense in knowing the wants of the vine. Generally I noticed that in the formation of trellises vignerons seem to be too hurried in wishing to complete their trellis, and so leave their rods too long the first year, instead of obtaining them by degrees, whence a longer life and better shape would result. Another fact that strikes me is the poor, low yield per acre, viz., 150 to 250 gallons per acre. When I come to consider that vineyards are planted in almost virgin land, I can hardly believe this, compared to the crops in some European countries, with almost identical climate, and soil already exhausted by other cultures. Vignerons complain of the scarcity, so it is worthy of investigation in order to find out the reason of it.

Viticulture in Australia has the character of what is called in rural economy "extensive as against intensive" cultivation, population being scarce and lands unlimited. Vines are planted wide apart. This is no doubt to economise labour by ploughing. Vignerons say that when vines are planted wider the average crop per acre is higher—that is a very well known fact, but it is hardly necessary to remember that there is a limit, and vignerons must not go too far; and I do not approve of the vines being planted 10 feet apart, the same as I saw in some vineyards. Yet I think that where the chief fault might be found is the shallow working. I have asked many vignerons how deep they plough, and the answer has been from 4 to 6 inches. I do not consider this is sufficient. Again, when the land is being made ready for planting, the trenching should be well attended to and the land disturbed to a depth of 20 inches to 2 feet. For instance, I lived for some time in a part of Italy famous for abundant crops, and in the boundary of this municipality the crop, when the *Peronospora viticola* (downy mildew) does not make any ravage, is about 22,000,000 of gallons in round numbers, the average per acre being from 700 to 900 gallons. Vines of 40 years of age are still vigorous. They are planted generally 3 feet 4 inches each way, the soil being trenched about 2 feet 8 inches, and each year they are worked four times by hoe, a couple of times from 8 to 10 inches, and the third and fourth times from 6 to 8 inches. The system of training is known as gooseberry-bush, with two or three branches, each with one spur, and each spur with two eyes. The climate is one of the warmest of Italy, the temperature being, as a rule, equal to from 88° F. to 90° F., and often attains to from 95° F. to 100° F. Rain is scarce, and there are many years in which from April to September there is not a drop of rain. The wine produced is chiefly white, and for many years it was exported to Switzerland, and since September, 1892, these wines have been the basis of the wine commerce of the Austria-Hungarian Empire.

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* Very likely there will soon be available some machinery fit for the purpose, for last November the Italian Government advertised an international competition of such appliances. Experiments are being carried out at the Royal Viticultural College of Catania (Sicily).

To shorten the distance to the minimum possible to which one can plough means to increase the yield, and nowadays we have some good patterns of ploughs made specially for vineyards. One must remember that vines in a hot and dry climate require much deeper trenching than 1 foot, well ploughing to a depth of 8 or 9 inches at least twice a year, and well scarifying as well. The trenching in such climates needs to be deeper, as the soil can absorb all the rains that fall during the winter and supply it by capillarity during the summer heats. A soil worked shallow very soon is saturated, and very soon dries up. Some might object that the deep working cuts many roots, but if anyone will attain the said depth, it will be better now to do so by degrees. Roots in hot climates develop best at a good depth, for there they meet a moister and cooler ambient, and so they can act all the time, while the roots at the top, when the surface is very dry and hot, are almost inactive. In cold climates we seek to do just the contrary.

In some cases I noticed an uncertainty about the most suitable pruning for each kind of grape Murray vignerons grow; and however easy it is to know the method of training of these vines in the locality they come from, still I believe that it is very important to determine if in this climate and these soils the different vines like the same training or a different, or at least a modification of the old system.

Suggestions regarding Wagga Experimental Vineyard.

Besides it is to be remembered that the aims of vine-growers in the southern districts of Australia are not the same as the vignerons of the old world, therefore I propose some acres of the vineyard annexed to the Experimental Farm at Wagga, and where numerous varieties are planted, be reserved for experimental pruning. When grapes are ripened we will weigh the crop, measure the quantity of both the juice and the musts, carefully weighing each, and find the percentage of sugar and the total acidity. From these experiments, after a series of years, we can obtain very useful conclusions.

I find that several people are experimenting with new remedies against vine diseases, as, for instance, the liver sulphur and the paraoïdium for oïdium, as against the "flowers of sulphur," the efficacy of which has never during forty years been contested. There also appears to be some uncertainty about the method of manuring vineyards, so that I think it would be wise to conduct some systematic experiments, which could be carried out in the vineyards of private proprietors, to determine each vital question, always aiming to increase the yield and improve the quality of the grapes by means economical as well as effective.

As soon as possible the Government should be able to supply vignerons with American phylloxera-proof cuttings, and the easiest way to do so directly is to graft on European stocks the American cuttings, for they develop more quickly, and they take a large wood development. Of the 12 acres of vineyard at Wagga Experimental Farm, 4 or 5 could serve this end for the present. Again, I am sure that some vignerons would be glad to do the same in their own vineyards. Phylloxera threatens, and if vignerons are not informed about the way of avoiding the ravages of this insect the time is not far distant when they will be discouraged and will not plant more vines. I know myself that the question of American stocks is not so easy as at first might seem, and it must be resolved case by case according to the quality of the soil and climate and kind of grapes that are to be grafted, for it is a fact that between some American species and some European varieties there is not much affinity. I do not think that this

is the place to go into details, but I repeat that the question is a complex and important one that does not admit any delay. Of course we can avail ourselves of the experience of the old world—experience which has cost time, money, and many disappointments to those vignerons; but there are questions of a local character which have to be resolved.

Hunter River.

When I think of the Hunter River district being at a 32°–33° southern latitude, and vineyards planted on flats or on slopes of a rather low altitude, it strikes me favourably, for I found there both red and white wines, light, and fit for direct consumption. Sometimes they are wanting in body, and then I think of wines from the southern districts to complete these and give them tonicity and roundness when they want them.

The quantity of rainfall, and especially its distribution during the physiological stages of the vegetation, is the most important factor, to which is due the peculiar character of the Hunter River wines. But very often, if the rain should last till the time of picking, the must is too watery, mouldiness invades the berries, the wines resulting are poor, not well constituted, very subject to alterations, and of inferior type. When the season is favourable and there is no rain at the time of gathering the crop, these Hunter River wines are simply delicious. I had occasion to taste a good many wines during my trip through the district, and some reminded me of the best table wines, both red and white, of the vintages of the temperate zone of the Continent. Their proper strength of alcohol, their delicate bouquet, the exact proportion of extractive substances and total acidity, the lively ruby colour for the red and the very thin yellow for the white, and some almost colourless, the clearness, softness, and freshness of their taste, make these wines types of the first quality, and worthy to compete with the best and most famous of Europe.

Again, a natural factor assists the production of these good wines. The *Botritys acinorum* (in German language, *Edelfaul*) is not only found in the most famous countries for table wines, but last vintage in Victoria I detected, I think, formerly, this useful fungus,* and surely it must be frequent in many of the Hunter River vineyards in good seasons, as far as I can judge from the descriptions that vignerons made of this *blue mould*, which is to them the signal of a future first-class wine.

This "*Botritys acinorum*" causes special modifications in the chemical composition of the must, with the result of more delicateness and nicer bouquet.

The future, therefore, of this wine-growing district depends upon two sorts of industries, viz:—

First—Making delicate, light, table wines, both red and white, when the excess of rainfall has not deteriorated the quality of the grapes.

Second—Making of good brandy from the poor but sound wines upon which there is not to depend for the local or home consumption, when for the sake of a bad season they are not worthy of commerce as wines. Distillated they will give a product of more value with a smaller volume, and yet will not come in competition with the wines fitted for consumption.

* *Argus*, Melbourne, 8th April, 1896.

I had opportunities of tasting some old and new brandies made in this district, and I must say they are really very good; however, makers have not yet cared to complete the natural goodness with those particular attentions that any brandy-maker never neglects. Such an industry, one day, will form the wealth of the vine-growers of the Hunter, for all factors, not the least of which is the big yield, agree, and, in my opinion, distillation on a large scale is the condition upon which depends the success of viticulture in this district.

Where the hail and late frost had not made any ravages vineyards looked healthy and crops promising. The system of pruning generally adopted is that of horizontal arms with spurs, which, if my judgment is not premature, suits well almost anywhere in these soils—peaty, and very rich in humus—and therefore vines have a great tendency to develop largely. Again, this system prevents bunches being too near the soil, where they might get rotted, especially when unseasonable rain falls, while it allows more ventilation, so that wet grapes more easily dry.

Also for the Hunter River vineyards I suggest that experiments be carried out at the properties of some of the vignerons in the same way that I proposed for both Corowa and Albury districts, adding too for all places, which have different characters of soil and climate, ampelonological researches which will determine whether the varieties till now grown are the best and most suitable from the triple point of view—say, agronomical, technical, and commercial; or if there are some others more worthy of being propagated, or at least select amongst those already existing the best ones, and so give ostracism to those that are unfit for our vineyards.

Thus I complete the report concerning my first visit to the most important vine-growing districts. Of course my judgments take their reasons only from what was to be seen during the time I was in the district, and from all the information I have been able to get from vignerons, whom I have to thank for their courtesy. I also express my thanks to those gentlemen who kindly conducted me to various vineyards, so facilitating the performance of my duty.

I would have reported here on a place where viticulture and oenology can be taught to students, but I beg to do this separately, and after I have collected more information, so that the subject may receive the utmost consideration.

Forest Moths that have become Orchard and Garden Pests.

By WALTER W. FROGGATT,
Government Entomologist.

The Mottled Cup Moth. (*Doratifera vulnerans*, Lewin.)

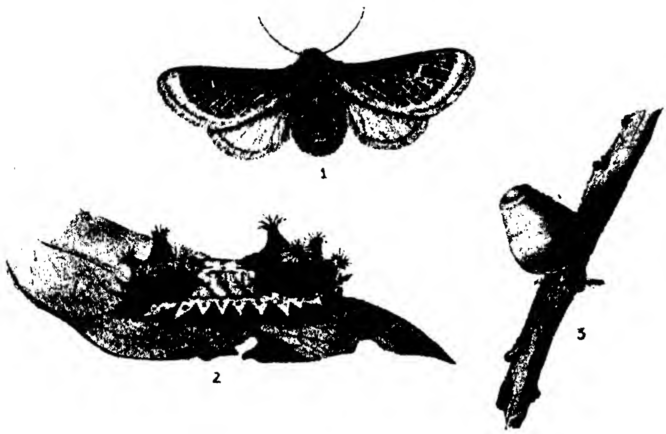
During the last year I have received a number of caterpillars and cocoons of this moth from various correspondents, in all instances taken upon apricot-trees; and have also found a number in my garden at Croydon, feeding upon the foliage, and attaching their curious cup-like cocoons to the young branchlets.

In their native state they are very plentiful about the bush upon the young gum (eucalyptus) trees, and nothing could be more unlike the strongly-flavoured aromatic gum-leaves than the foliage of these fruit-trees. The caterpillars are short, broad, snail-like creatures of a bright-green colour, covered with curious raised warts, each armed with a cluster of sharp spines which the caterpillars can protrude when startled, or withdraw at pleasure by a muscular contraction. These grubs are well known as "stinging caterpillars," for if they come in contact with one's bare arms these spines cause a sharp burning feeling that lasts for some time.

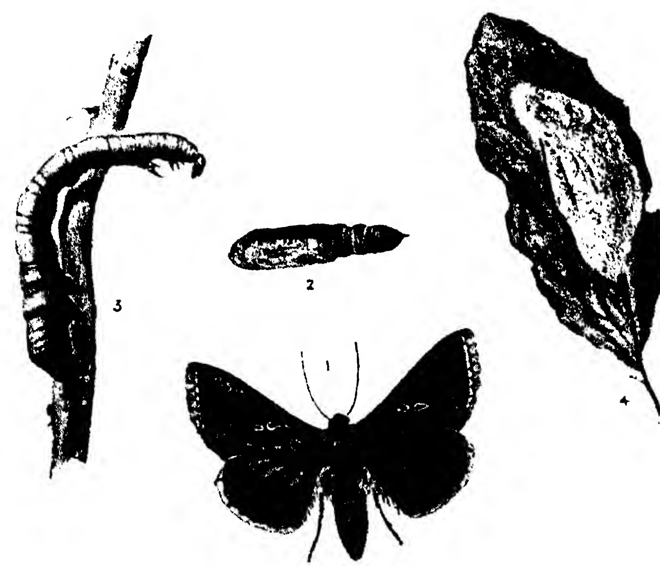
The spines are situated in a rosette-like bunch upon four raised fleshy tubercules on the fore and hinder part of the back, the middle of the body being flattened, with a fringe of slender points along the sides; the head and legs are hidden when viewed from above. When all the spines are expanded the larva is a very handsome little creature. In feeding upon the gum-leaves it moves along, ploughing a furrow out of the epidermis with its sharp jaws, so that a tree badly infested by them has its foliage covered with brownish scars; but the apricot leaves being so much thinner they eat the whole of them, often stripping every leaf off the branches. The caterpillars are full grown in April, and breed readily in captivity; the moths emerge in November.

They construct very curious oval cocoons of a tough brown paper-like substance, smooth and thin, not at all like the ordinary silken cocoon of most moths; they are attached to the branch at the base, standing out and slightly contracted towards the apex, which is fitted with a very curious saucer-like lid, which, though firmly attached, is easily pushed off when the moth is ready to emerge.

The male moth is slightly over an inch across the outspread wings, the female somewhat larger; the general shape is short and thick-set, the fore wings broad and rounded behind, of a pale mottled reddish-brown colour, with the hind pair of a uniform light brown. The female has the fore wings



THE MOTTLED CUP MOTH.
(*Doratifera vulnerans*, Lewin.)
1. Moth. 2. Caterpillar. 3. Cocoon



THE SILVER SPOTTED PLUSIA.
(*Plusia verticillata*, Gn.)
1. Moth. 2. Chrysalid. 3. Caterpillar. 4. Cocoon.

more thickly mottled with reddish brown, the edges banded with a fine grey line with an inner darker line, followed by another grey mark forming a broad band at the tips.

The caterpillars of this moth have a very persistent enemy in one of our large ichneumon wasps (*Merosternus albopictus*, Smith), which deposits its egg upon the grub before it spins its cocoon, and when the wasp is full grown it gnaws a circular hole through the side of its prison, as, unlike the moth, it is unable to push the lid off.

This parasitic wasp is of a uniform black colour, marked upon the head and thorax with creamy white lines, the segments of the abdomen being finely barred with rings of the same colour; the long powerful legs are red, the base of the thighs and shanks black; the female is provided with an ovipositor, consisting of three fine black bristles projecting beyond the tip of the abdomen by which she is enabled to deposit her eggs upon their living host. This ichneumon measures about half an inch from the head to the tip of the body without including the long slender antennæ and ovipositor; the large transparent wings with black nervures having an expanse of about an inch.

Remedies.—As these caterpillars appear after the fruit has been gathered they will not do the damage that they otherwise might if they attacked the foliage earlier in the season. Spraying with Paris green would be a very effective remedy to rid the trees of the caterpillars, and any cocoons found upon the trees could be destroyed when pruning later.

The Silver-spotted Plusia. (*Plusia verticillata*, Gn.)

Towards the end of last March I received a number of caterpillars and chrysalids of this moth from Mr. George Beyer, with the information that they were destroying a fine creeper (*Cobæa scandens*) covering the verandah in front of his house at Redfern.

The caterpillars are of a general pale-green colour, with the head small, tinted with yellow and spotted all over with black; the back and sides ornamented with a number of fine, hair-like white lines, running parallel from behind the head to the tip of the body, with a small black spot on the side, in the middle of each segment. They are long, slender larvæ, with three pairs of claspers or prolegs upon the sixth, seventh, and terminal segments of the abdomen, as well as the three pairs of true legs on the thoracic segments. Their mode of progression is very peculiar, and reminds one of the geometer or loopers, as they arch their backs into a rounded loop, moving first the fore part of the body and then drawing up the hind part, and sometimes resting erect, supporting themselves with the claspers, and apparently looking round before taking the next step.

When full-grown they spin a thin, elongate, silken cocoon upon the underside of a leaf; the pupa being at first pale green, changing to a dull brown before the moth emerges. The pupa is not quite an inch in length, slender and cylindrical, with the head rounded, and the wing-cases curving round to the base of the sixth abdominal segment; the tip of the body terminating in a slender, tubular projection.

The moths, which begin to emerge within a fortnight from the time that the cocoons arq spun, measure an inch and a half across the wings; the fore pair mauve and brown, marbled with a coppery tint, with two elongate oval spots of silvery white scales in the centre of the wing, and two slender transverse lines close to the base; the hind wings dark brown, fringed with long greyish down upon the sides. The head and thorax are

thickly clothed with coppery-tinted brown hairs, two tufts rising up behind the head and forming a curious horn-like crest, which is very noticeable when the moth is at rest, with its wings folded.

Again, however, we have a natural check to the increase of this moth in a minute hymenopterous parasite belonging to the family *Braconidæ*, which in this instance destroyed more than half the caterpillars. These tiny wasps are hatched from eggs deposited upon the caterpillars, and feed upon the tissue of their living hosts until both they and the caterpillars are about full-grown. They then eat their way out of the unfortunate caterpillars, and spin their little silken cocoons upon its remains, often little more than the skin.

Where every infested caterpillar has died, instead of a moth-cocoon will be found a cluster of little white eggs, like cocoons, often fifty or more in number. I have known people to destroy these, their most useful allies in the destruction of many injurious moths, under the impression that they were the eggs of moths; but a very slight examination will show the difference.

This braconid wasp is hardly more than the twelfth of an inch in length, with long, black, curving antennæ, long slender legs, and dainty, gauzy wings, and is of a general black colour with the exception of the centre of the abdomen and the legs, which are reddish yellow. Scores of these little creatures may be seen flying round the plants, waiting for an opportunity to place their eggs and so quick and active in their movements that it is easy to pass them by.

The *Too* Common Crow.

W. FARRER, Lambrigg, Queanbeyan.

DR. COBB's special pleading on behalf of the common crow in your September issue is amusing and good reading, but I cannot help thinking his object in writing it was to provoke a reply rather than to carry conviction. Possibly he wanted to draw out a response to the Minister's invitation to outsiders, to contribute to the *Gazette*, which appeared in the same issue. At any rate, his statement that "the simple truth is that crows do more good than harm," and that "of the two, man and crow, the former (by killing the latter) is showing himself to be the more stupid and the more blind to his own welfare," is one that he cannot possibly have expected to go unchallenged. I shall, at any rate, attempt to combat it in this hurriedly-prepared paper.

Dr. Cobb waxes eloquent in his admiration of the intelligence of the crow, which he all but holds before us as a model for imitation. Few of us, I hope, will approve of this model. It is not because his colour is black that the crow is disliked. I think we are all broad enough to think, even if we do not know, that good birds, like good horses (and good men, too, for that matter), may be of any colour. The reason of our dislike for the crow is that he is the very embodiment of mere cunning,—of aggressive, impudent, cruel, and unscrupulous cunning—without a single redeeming quality. Henry Ward Beecher is wrong, I think, in what he says about the superior cleverness of crows over men. Men have no need to be feathered out and given a pair of wings to become clever enough for the crows. I am inclined, on the contrary, to agree with our own Henry Lawson, who probably knows more about crows than Mr. Beecher did, when, in his "Drover's Wife," he says:—

"She fights the crows and eagles that have designs on her chickens. Her plan of campaign is very original. The children cry, 'Crows, mother!' and she rushes out and aims a broomstick at the birds, and says, 'Bang!' The crows leave in a hurry. They are cunning; but a woman's cunning is greater."

It is evident, from what Dr. Cobb says about it, and from the description of its manner of going to roost, given by Samuel N. Rhoads, and quoted by him, that the American crow differs considerably from our own, as well as from the English crow. Of the latter, the late Rev. J. G. Wood—a good authority on British birds—says that it, "unlike the rook, is not a gregarious bird, being generally seen either single or in pairs, or, at most, in little bands of four or five." The fact of our own crows being less gregarious than the American is probably of some consequence, for the writer on Ornithology in the *Encyclopædia Britannica* (8th edition) says of crows, "Some species are gregarious, others unsocial; the latter being the more carnivorous; but even they are observed to associate together when a large quantity of food

attracts them to a certain place." This has certainly been the case whenever I have seen our own crows in flocks; it has been when the fruit in my orchard has been getting ripe, and then they come in flocks of as many as twenty, and deal greater destruction to my fruit than all the other birds put together; in fact, they generally to all intents and purposes destroy the crop, not merely by eating considerable quantities, but by knocking down the apples and plums before they are ripe. If, then, the American crow is gregarious, the probability is that it also differs materially from our own and the English crows in its other habits; and that it is less carnivorous, more insectivorous, less objectionable, and more beneficial.

It is evident that Dr. Cobb is innocently ignorant of the loss of stock—particularly of sheep and lambs—which is caused by crows. As a matter of fact, the loss, especially of lambs, is by no means trifling, and represented in money, would, over the whole Colony in a single year, aggregate enough to make both Dr. Cobb and myself very rich men. But it is not the material loss which exasperates so much; it is the manner in which the loss is sustained. In reference to the picking out of the eyes of sheep, which are weak or bogged, Dr. Cobb makes three statements—(1) That "it is a relatively rare occurrence; (2) that "in most cases the sheep would die anyhow"; (3) that "the crows simply hasten the process of dying." In reference to the last of these statements, my own opinion, derived from the amount of danger which is known to attend the removal of an eye in the human subject, is that the picking out of the eye by crows, even when the sheep is really dying, is not likely to hasten the end materially, but only to add to the agony of what must almost always be in any case a painful death. In reference to the two first statements, they are both negatived by the fact, placed in my possession by a reliable and competent authority, that sheep which have had an eye picked out by crows are by no means uncommon on runs; and more than that, that cattle which have lost an eye in a similar manner are not very uncommon. I have it also, on the authority of a trustworthy man, who, in the old shepherding days had much experience in tending lambing ewes, that it is quite common for ewes to have their eyes picked out while they are in a helpless state during the act of lambing; and more than that, my authority affirms that he has frequently known lambs to have their eyes taken from them by crows before they have become free from their mothers. Dr. Cobb can scarcely say that lambing ewes or partially-born lambs "would in most cases die anyhow." But enough of this subject. It will surely be worth our while to see if we cannot get along without such an odious brute as the common crow.

The matter of the loss of chickens and eggs is of relatively small importance; but this loss, too, in the aggregate, is by no means small. In my own case, I am sure it comes to two or three pounds yearly, while the added exasperation, were it possible to express it in money, would considerably increase this sum.

Dr. Cobb says we are fools ("stupid," to be more exact), for killing crows on account of the great amount of good they do by killing grasshoppers. Dr. Cobb's position is that crows, on that account principally, ought not to be killed. I say we are acting wisely by doing our level best to exterminate them. This is the issue between Dr. Cobb and myself. I shall now try to show that I am right.

I will begin by pointing out that a scarcity of small birds is a disadvantage this country already suffers from. This, I believe, is generally admitted. During a residence in the Colony of over twenty-seven years, I have come to the conclusion that this is an increasing evil. It happens that I resided

for two years in this district immediately after I arrived, and so can make a comparison of the state of affairs which obtained here then and now. Two birds which appear to be much rarer now than they were then, are the soldier bird and the plover. By "the plover" I mean the different kinds of that bird which are found hereabouts. Twenty-seven years ago soldier birds were quite common. Nowadays it is seldom that I see one. Plovers have become rarer still. Small birds also, generally, unless it be parrots and fly-catchers, appear to have decreased in numbers; while the only bird which seems to have become commoner is the crow. It looks as if the settlement of the country, and, notably, the stocking it with sheep, has created a state of affairs which is specially favourable for crows. There is more carrion and more of helpless animal life on which crows can prey—more food, in fact, which crows, more than any other birds, can make use of, than there was before the country was stocked; and the result of this has been a gradual increase of crows, which appear to be in greater numbers in the older than in the newer settled pastoral districts. The new conditions, also, appear to have led to a progressive decrease of many small birds. If these be facts, as I believe they are, I cannot help thinking there is some connection between them; and I will now attempt to see if there is.

I will begin by trying to get an idea whether a substantial diminution in the number of crows would be likely to have any effect on the numbers of other birds. I fear, however, that in making this attempt, inasmuch as I have never given attention to the study of either birds or insects, and the authority on birds from whom I sought for specific information, has not responded to my application, I shall be only too likely to prove myself to be guilty of unwisdom equal to that which Dr. Cobb says attends the killing of crows. I shall, therefore, from motives of prudence, deal with details as little as possible.

In regard to the crow and its food-habits, Dr. Cobb says, "It is omnivorous, but fond of insects, especially grasshoppers; a hunter of rabbits and similar small mammals. [Of rabbits, only when young and small, I think.—W.F.] A robber of birds' nests; * * * without objection to carrion." This description I accept in its entirety, and will make use of for my argument.

The crow, then, from the fact of its being omnivorous, competes for food with practically all other birds (such small birds as the fly-catchers are, I presume, excepted); and as the number of birds which are dependent on any one kind of food is limited by the quantity of that food which is available for them, if crows were diminished in numbers, and more so, if they were all destroyed, there would be more food available for practically all other sorts of birds; and as the crow is relatively to the average of other birds, of large size and large in its food requirements, the crows got rid of would be replaced by a larger—probably by a much larger—number of other birds: that is to say, a most objectionable and odious, and, as I think, in the main a most harmful bird would be replaced by a greater number of other birds; also, as beneficial and attractive ones are in a majority amongst such other birds, beneficial and desirable ones would preponderate in this greater number of other birds we should get. This result, be it clearly understood, would follow solely from a larger quantity of food becoming available for other birds, in consequence of a diminution in the number of crows.

It is not difficult to see from another point of view that a large increase in the numbers of most of our birds would quickly follow as an immediate result from a reduction in the number of crows. Dr. Cobb mentions that the crow is a "robber of birds' nests." We also know how rough he is on

young chickens, and we may be quite sure he is at least equally destructive of young birds—of fledgelings especially. So destructive is he of birds' eggs and of young birds, that I think the number of young birds which arrive at maturity, in comparison with the number of eggs which are laid, must be quite small; and that however prolific of eggs any of our birds may be, if their nests and eggs are exposed to such an enemy as the crow, there is little chance of their increasing in numbers, or even of their holding their ground, while such an enemy continues to exist in such numbers, as at present does the crow. For, as Wallace says in his 'Darwinism,' "It is usually the amount of destruction which an animal, or plant, is exposed to, and not its rapid multiplication, which determines its numbers in any country"; and again, "in animals, it is the eggs or very young which suffer most from their various enemies." From whatever point of view, then, we look at it, many crows means few other birds.

The birds which suffer the least from crows are those whose nests are concealed, or in places the crows cannot reach, as in holes in the ground, or in spouts of trees. Amongst the birds protected in this manner are those mischievous pests the parrots, or that even worse pest the introduced house-sparrow. It is a comfort to think that no material increase in the numbers of these birds would be likely to follow as a consequence from the destruction of crows.

In regard to the main benefit we derive from the crow—the destruction of grasshoppers—surely there are many other birds which would do the work just as well. One of these, I know, to be the common black and white magpie; and ornithologists could doubtless give us the names of many more—probably quite a list of them. Now, the magpie builds an open nest, which is fully exposed to the crows, and I am sure he suffers greatly from their depredations. The fact that magpies are often seen chasing crows is evidence of this. The magpie, then, is one of the birds which would increase in numbers in proportion as crows diminished. We would probably get three magpies, and quite likely more, in the place of every crow, and three magpies would be able to destroy, I think, at least as many grasshoppers as any one crow. Another beneficial bird (one of the many which appear to have diminished in numbers during late years), whose nest is exposed to crows, is the magpie-lark (or Peewit, as some call it; and incorrectly, as I think, for that name is generally given in England to the commonest kind of Plover). This bird, as Dr. Cobb himself has pointed out, does yeoman service by destroying large numbers of the land mollusc, which he himself has discovered serves as a host for the fluke in one of its earlier life-states. Plovers, also, probably do the same good work; and their nests are specially exposed, and entirely unprotected. Magpie-larks, then, and Plovers are birds whose increase would follow the destruction of the crow; and it is more than probable that the increase in the numbers of these birds would be so great that the fluke-pest would be very materially diminished; for it is apparently only while he is within his mollusc-host that the fluke can be got at, and then best, and possibly only, by means of mollusc-eating birds.

As for the good the crow does in the way of keeping down small mammals, and eating carrion and carrion-eating insects, there are doubtless less objectionable birds ready to take his place, and to do the work equally well, if they are only allowed to increase. Owls, several sorts of hawks, laughing-jackasses, &c., prey on the smaller mammals; while the harmless meat-hawk would doubtless increase sufficiently to give a good account of the carrion. The only work, then, the crow does, for which we are not likely to find a substitute, which would do the work equally as well, is the picking out of

the eyes of weak or bogged sheep, of lambing ewes, and of partially-born lambs, as well as of favourite old horses, and possibly of an occasional dying or drunken man. I move that we make an earnest effort to do without both the crow and a substitute for this last work of his.

It is possible, again, to see the character of the results which have followed elsewhere from the partial extermination of the crow. Some sixty or seventy years ago—before game was valued and preserved as closely as it is now over the whole country—crows were numerous in England; but thanks to the efforts of gamekeepers (gamekeepers, after all, do some good) the crow has become a relatively rare bird—so rare, as to be, for all the good or harm he does, practically extinct. We are in a position, therefore, to see in England what has actually resulted from such a diminution in the number of crows, as I would like to see made here. One thing we know is that game-birds, which make open nests on the ground, as for instance, grouse in the north, and partridges in the south, have increased enormously in England. Although grasshoppers (I do not know if the English species differs widely from our own in its capacity to do harm) were fairly common in England as far back as I can recollect—some forty-five years ago—I have no reason for thinking they have become more numerous since then, and I have never heard of their doing harm; nor has there ever come under my notice a single evil result which has been attributed, or is attributable, to the practical extinction of the crow; while the desirable results which have followed are many and undisputed. Small birds are certainly more numerous in England than they are here, and appeared, the last time I went Home, to be at least as plentiful as they were in the far-back days of my boyhood; and that, in spite of the increase we know to have taken place in the number of boys. The poultry-loving housewives, also, of our motherland, lead placid lives; while farmers, instead of crows, grow lusty on lamb.

I trust I have now succeeded in showing that our crow is already only too common; that disastrous results are little likely, but, on the contrary, that desirable results of all sorts are likely to follow from his destruction, and that those who are actively striving for his extermination are directed by good reasons and patriotic, and in every respect the reverse of stupid.

We will now go on to see if we cannot circumvent and destroy the crow without being feathered out and provided with wings. The plan we are making use of here, or probably one of a somewhat similar character, will most likely have to do until Mr. Hargrave has finished his experiments: then we shall probably be better able to meet the crow on his own (?) ground.

The plan I have adopted is very simple, and, as far as I can see, effectual. It is to make a saturated solution of strychnine by dissolving this substance in a mixture of vinegar and water, being careful not to use quite so much of the vinegar and water as will dissolve all the strychnine. This solution I like to make an hour or two before it is wanted for use. By means of a hypodermic syringe, I inject five minims of this solution right into the yolk of an egg, through a hole in the shell made with a pin. Graduations on the glass barrel of the syringe allow the quantity injected to be regulated with great ease; but five minims is about as much as an egg of ordinary size will take. The poisoned eggs I carefully mark "Poisoned" before I lay them out after sundown in open places the crows are in the habit of frequenting. It usually happens that every egg has been taken by breakfast time next morning. Dead crows which have been found in the bush adjacent to my place after I have laid poison in this manner, have shown that the poison, to some extent at any rate, had done its work. The first time I tried the poisoning of eggs, I made the strychnine solution too weak, and crows which

had taken the eggs were observed to eject the poison from their mouths and recover: but thus far, I have every reason for thinking that the stronger dose is successful. Should strychnine prove to be less effective than at present I think it is, I shall experiment with other poisons. One thing, however, which I look upon as certain, is that an egg is the best vehicle in which to give poison to crows; for an egg is a temptation which no crow appears to be able to resist, and poisoned eggs still continue to be taken here just as readily as they were the first time I put them out. An objection which may prevent many from using this plan is the cost of the syringe, which, I believe, at present is 20s. in Sydney. I see, however, that the price in London (at the Army and Navy Stores, 105 Victoria-street, Westminster) is 9s., and as its weight, including case and accessories, is a trifle over 7 oz., it could be delivered in this country by post, securely packed, for 9s. 6d. Probably some of the Sydney firms who deal in such things would supply this syringe at a fair price, if a demand for it should arise.

I have often wondered that the Stock and Pastures Boards have not done more towards the destruction of crows. I expect a want of knowledge of what consequences would follow—that caution, in fact, has been at the bottom of their inaction. I trust this paper may enable them to see their way to acting with vigour.

Mr. A. H. Bray, of Bijiji, in a letter dated 9th December, 1896, says:—"In the September number of the *Gazette* Dr. Cobb stands up for the crow, and says 'it is high time he was let alone.'

"Dr. Cobb also makes an interesting estimate as to the number of tons of grass-hoppers eaten by crows in the Moss Vale district in the year 1894. An equally interesting estimate might be made as to the number of tons of grapes eaten by crows every year in the Murray River district, but I shall refrain, and simply give you my own experience as regards the crow.

"To begin with, I may state that we see very little of crows for something more than ten months in the year. At the present time the grass paddocks are swarming with grass-hoppers, and there are also plenty among the vines, but there is not a crow to be seen on the place. They arrive in flocks of 500 or 600 about the end of January, and from then until the grapes are picked I find it necessary to keep two boys shooting at them in the vineyard. They do not remain among the vines all day, but have to be watched for from sunrise until 10 a.m., and again from 4 p.m. until sunset.

"If the crows were not driven away they would not leave a single grape on the place."

Fruit-drying.

C. H. GORMAN,
Manager, Pera Bore Experiment Farm.

THIS industry in New South Wales is as yet unknown, except by those people who are drying in small quantities for their own use; and I think a few notes on the subject might lead to its being taken up as a profitable means of livelihood. People may ask, why dry fruit? Its real object is that fruit may be had out of season in places where fresh fruit cannot be shipped or kept for any length of time, and all the characteristics of the fresh fruit retained. To describe all the methods followed out in fruit-drying would require considerable space, so that in this short paper only the most approved and most easily-applied methods will be treated.

I would first advise intending dryers to see that their land is adapted to the class of fruit they intend producing. As an example, peaches will thrive on almost any soil, apricots do best on a heavier soil, prunes require a loamy soil in order to produce fleshy fruit, whilst vines will bear well on almost any soil. Having selected your site and planted your varieties, do not run away with the idea that it is only a matter of waiting for the crops; your real work has only commenced. Proper care and attention must be exercised in order to produce good fruit for drying. Good fresh fruit will make good dried fruit, and bad fresh fruit bad dried fruit.

Peaches and apricots are, so far, the most widely cultivated in Australia, and it would be as well to treat with them first of all. A dry climate is first required—no fogs nor dews—so that drying can be done night and day. A moist climate is likely to strengthen the chance of moths and insects depositing their eggs in the fruit when exposed. Again, in a dry climate the trays can be emptied sooner, and fewer trays will be required, which is somewhat of a consideration.

Care must be exercised in choosing the varieties best adapted for drying. In peaches, the best varieties are Muir, Lady Palmerston, Elberta, Foster, Salway, Early Crawford, Susquehana, and Globe; in apricots, Moore Park, Blenheim, Hemskirke, Royal, Alsace, and Oullin's Early. Any one of these will produce a first-class dried fruit. Picking the fruit is another point requiring care. Only pick the very ripest, and do not break or bruise the fruit. Some kinds of peaches can be shaken on to sheets placed beneath the trees, and lifted by four men, one at each corner, then rolled gently into picking-boxes. A picking-box should not contain more than from 25 to 30 lb. of fruit, otherwise the weight will bruise the lower layers of fruit. The fruit should be taken from the orchard, and carried as carefully as possible to the cutting-shed. Here the fruit is cut in half, a clean cut right round, so that the pit is taken out without breaking the flesh. These halves are placed on trays, *cut side up*. Avoid as much as possible exposing the cut

fruit to the air until after sulphuring. The most convenient sized fumigator is 12 ft. x 10 ft. A room that size should contain 300 to 350 trays, and can be moved to any part of the orchard. Peaches require about two hours sulphuring, apricots about twelve, but the fumes should not be kept up longer than to set the colour. The fruit should be taken out when the cup, formed by the removal of the pit, is full of juice. This must always be taken as a guide in sulphuring. If the fruit is thoroughly ripe it is an easy matter to bring the juice up, and in exposing to the sun it loses less weight, and is easier to dry. Peaches dry away in the proportion of from five to six and a half to one, according to the variety. Apricots in the proportion of four and a half to six to one. The exposure must be regulated according to the evenness of the climate and the temperature. Usually peaches and apricots take from two and a half to four days. As soon as they are dry they must be put into clean calico bags, made to hold from 40 to 60 lb. When tied up, the bags should be taken at once to the packing-shed, allowed to stand a day, and then packed as desired. As I intend treating the subject of packing in another article it will not be necessary to say how the packing should be done now.

Figs are the most difficult of all fruits to dry, and up to the present Australia has not been able to compete with the Smyrna dried fig. In Victoria now, thanks to the methods introduced by the dried-fruit expert, Mr. C. Bogue Luffman, from Smyrna, the Mildura growers are fast bringing their figs up to the standard of the imported article. Figs should be picked in the early morning, and put on trays with the bloom end pressed down, thus preventing insects from entering the ends, and keeping them from souring. When dry they should be dipped in a solution of caustic soda in the proportion of 1 lb. of caustic soda to 8 gallons of water. After dipping, they should be allowed to stand out for a day to a day and a half. Then pack in a sweat-box, and allow them to stand for a fortnight before packing. As much pressure as possible should be applied, so as the air may be thoroughly squeezed out and the flesh brought together. Figs dry in proportion of 2 lb. of green fruit to 1 lb. of dried.

Up to the present the Gordo-Blanco grape has proved the best for raisin-making in this country, though the Malaga raisin is manufactured from a different variety. Australia can well be proud of some of the samples of table and pudding raisins manufactured. Raisins are divided into three classes, London Layers, Loose Muscats, and Lexias, or dipped raisins. These classes, however, have their different grades according to size, quality, colour, &c. Grapes should be picked when thoroughly ripe, and great care must be exercised in so doing. The best and most complete bunches are placed on separate trays, and are made into layers or table grapes, the inferior bunches and loose berries are put on other trays to be dried as loose muscats or Lexias. If it is intended to make Lexia raisins they must be dipped directly after picking in a solution of caustic soda or Greenbank lye, in the proportion of 1 lb. of caustic soda to 10 gallons of water, immersed for five seconds. The object of dipping is to secure a bright amber or golden colour—merely an imitation of the imported Eleme raisin. It is a cheaper method of drying than the loose muscat, but it is hard to understand why the public prefer them. However, the experience has been that they will have them, and a fruitgrower knows to his cost that the public have to get exactly what they want. Lexia raisins usually take a week to dry, whilst loose muscats require a fortnight, and in some cases I have known them to be exposed for six weeks, for this reason that if exposed in a temperature over 98° in the shade they burn and blacken, spoiling the bloom and flavour. In

such cases the trays should be stacked and protected. Sorting must be properly attended to, only those berries thoroughly dried should be taken off the trays, as sometimes the berries dry unevenly, and in going through the stemmer and grader the half-dried ones break, and once broken they "sugar" or "sour" very quickly. This is applicable only to loose muscats and Lexias, for London layers have the stems left on and are a fac-simile of the bunch when on the vine. Of course in layer raisins all dried-up and injured berries must be removed before packing.

The Sultana grape should always be dipped, but not for more than a second, as the skin is very tender and requires very little to crack the skin. I would recommend the dip being 1lb. caustic soda to 12 gallons of water. The method of sorting before mentioned should be carried out. The Zante Currant requires no dipping, and is the easiest of all fruits to dry. Carefulness and cleanliness are two points that should be encouraged. A variety that is fast gaining favour over the sultana is the Thomson Seedless Grape, a variety introduced by W. Thomson, of Yuba City, and then known as "Lady Decoverley." Dr. Eisen describes it as follows:—"Oval; greenish yellow; as large as a sultana; seedless, with thin skin; bunches very large; vine an enormous bearer."

Coffee-growing.

C. SKELTON.

My attention having been drawn to a paragraph adverting to a sample of coffee having been forwarded to the Department of Agriculture from the Clarence River district, as an ex-Ceylon coffee-planter, I felt interested in the fact that coffee could be produced in New South Wales, and called upon Mr. W. S. Campbell—of the Department—who was kind enough to show me the sample, which though only partly cured, being in the "parchment"—which, together with the silver skin having to be removed before it would be considered a marketable commodity—goes to prove that a fair quality of coffee can be grown in the Colony. The bean seems full, and of a tolerably good colour; so far as I can judge it would fetch from 65s. to 70s. per cwt. in the London market; were it cured in "plantation style" it might realize from 20 to 25 per cent. more. The question to be solved is, what yield per acre can be obtained from the plant in the latitude of the district where the sample was produced, for coffee is indubitably a tropical product and requires plenty of heat and moisture. What I am afraid will be found most detrimental to the success of coffee in this Colony are the frosts that even in the most northerly parts of the Colony are occasionally experienced. In Ceylon I once saw a field of coffee killed right out by one night's slight frost; it was at a very high altitude, about 5,000 feet, and it must have been of very rare occurrence, for the trees were ten or twelve years old when they were bitten. However, if that difficulty can be surmounted and labour obtained at a reasonable figure, the coffee would have to yield from 50 to 60 bushels of "cherry" coffee per acre—equal to about 6 cwt. per acre, or about ½ lb. of clean coffee per tree—to pay working expenses and leave a fair profit.

To the intending planter a few hints from one with seventeen years' experience at coffee-growing may not be amiss. Choose, if possible, land naturally drained, a gentle slope is preferable, so that surface water will not lie and sour the soil. Good friable soil, of course, is a desideratum, it need not necessarily be very deep, as coffee is a surface feeder. Avoid cold, wet clay sub-soil, as immediately the tap root reaches such a sub-soil the tree will be observed to decline and ultimately die of what Ceylon planters used to technically term "wet feet"; the only cure for it is sub-soil draining, and that runs into a lot of money. The land obtained, the next thing is to make a nursery. Clear a piece, sufficient to raise plants for the area you intend to open, which, planted at 6 feet by 6 feet, runs to about 1,200 plants to the acre. Trench the ground and lay it out in beds, as you would a vegetable garden. Procure some coffee in the "cherry"—a bushel of cherry coffee will yield somewhere about 30,000 seeds, sufficient to plant about 25 acres—and pulp it by squeezing between the fingers, plant the

seeds in the prepared beds 9 inches by 9 inches apart, with just a covering of earth over them. Water every morning and evening, unless it rains, and continue to do so until the plants are 3 or 4 inches above ground, and afterwards, should the weather be dry, give them a good watering every alternate evening or so. Meantime, while the plants in the nursery are coming on, your land is supposed to be in process of being cleared. Let the logs that have not been consumed by the fire remain on the ground; stumping also is unnecessary, as there is no ploughing to be done. Get some thousands of pegs cut, about 15 inches long; with these and a lining rope (an ordinary clothes line will answer), marked at every 6 feet with a piece of rag, or something let into the twist, proceed to mark off your ground in parallel lines 6 feet apart. Keep your lines as straight as possible by using three ranging rods, or wadd sticks, as they are usually called here. You will find the benefit of having your trees in straight lines afterwards in working the place; besides, nothing looks so bad as an irregularly lined field of coffee. It may sometimes be found necessary to cut or roll a log out of the way in order to get the peg in its proper place. When all the lining is done proceed to dig a hole 18 inches deep, by the same in width, at each peg, leaving all the soil dug out in a heap at the lower side of the hole. Scrape all the surface soil and ashes left from the burning off into the hole till it is heaped up, as it will sink considerably, then stick back the peg into the heap to mark the hole. After the holing and filling in is finished, seize the opportunity of the first wet weather to plant out your nursery plants, which, we will suppose, are now five or six months old, as it will take about that time to prepare the land for their reception. Lift each alternate plant, either by pulling them up and carrying them out to the field in bundles, or, if you have time and labour to spare, lifting each with a ball of earth at the root and taking them out to the field on trays of some sort. The latter way is the best when it can be done, but if you have a large field of 80 or 100 acres to plant up it takes a lot more labour to do it. Be sure not to put the plant in too deep, but only to the same depth that it stood in the nursery; it is a mistake that is often made to plant too deep, the leaves grow yellow and the plant seems strangled, and often takes a long time to recover. It is a good plan to put the plant in a little deeper than you intend to leave it, place the earth round the roots, then stand with a foot on each side, and give the plant a steady, gentle pull upwards—that brings all the roots straight. If you have favourable weather probably most of your plants will come on all right, but there are sure to be some failures, and filling up vacancies with the plants left in the nursery should be carried on at every opportunity, that is whenever you have wet weather. Planting completed, there is nothing much to be done except keeping the place clear of weeds, cutting any roads or drains that may be found necessary, and erecting some sort of temporary house accommodation for self and labourers, which should be of the cheapest, until such time as you can see how things are going to "pan out." In eighteen or twenty months the plants will have grown sufficiently high to be topped—that is, cutting the top off the plant at 3 ft. 6 in. or 4 feet, according to soil and aspect, if at all exposed to wind the former height is the best. Topping has the effect of making the tree spread out laterally, covering the ground from the sun, thus tending to prevent the growth of weeds, besides facilitating the gathering of the crop. Trees grown in the "native" style—namely, allowed to grow to their full height, never bear more than half the crop they otherwise do, having so much useless old wood to sustain, besides the difficulty of gathering crop from branches 8 or 10 feet from the ground. In the third year the "maiden," or

first crop—generally amounting to 2 or 3 cwt. per acre—may be expected, and preparations accordingly will have to be made for it by erecting the necessary pulping-house, store, and platforms for drying the coffee upon, purchase of machinery, &c. I may here state that in selecting a site for the works it is absolutely necessary to fix upon one to which it is possible to lead a stream of water, and if practicable, sufficient to drive a water-wheel, which will be found a very great convenience and saving of labour; in fact, if any considerable area is to be put under coffee it will be found almost impossible to get through the work without one; in any case water is indispensable for pulping and washing the crop. To give directions for the erection of the necessary works, to be of any practical use, is scarcely within the scope of an article of this sort. Illustrative diagrams would have to be given and the most minute details entered into to make it intelligible to the ordinary understanding. Messrs. John Walker & Co., Bogambra Mills, Kandy, Ceylon, supply all the machinery necessary on coffee plantations, and if applied to, I have no doubt will be glad to forward price lists. A Walker's disc pulper, sufficient for the crop to be obtained off 25 or 30 acres of coffee, can be purchased for about £15; laid down in this Colony for about £17 10s.

In Ceylon and Southern India the usual estimate for bringing coffee into bearing was £10 per acre; that embraces felling, clearing, planting, and general maintenance till the coffee begins to yield returns, namely, in the third year after planting. As previously stated the first or "maiden" crop is usually from 2 to 3 cwt. per acre; it goes on increasing up to the sixth year, when the tree is supposed to be in full bearing, when with good soil and favourable seasons it may yield 10, 12, or even 15 cwt. per acre. Under these circumstances it is not difficult to see how paying a speculation coffee-growing is, with annual working expenses at £8 or £10 per acre, and London ruling prices for "plantation" coffee at 100s., and sometimes over that, per cwt. Unfortunately, results do not always come up to expectations; the coffee planter, like the farmer, has many difficulties to contend with, white bug and black bug, too much wet or too much dry weather, scarcity of labour at critical times when he most requires it, and, sometimes, that which is worst of all, scarcity of money. However, taking it all in all, a little discomfort and hard work is easily borne when there is a prospect of making a competency, of which I do not think there can be much doubt should judgment and care be exercised. It is as easy to lose money at coffee as it is at almost anything else with a reckless hand at the helm.

Crimson (or Scarlet) Clover.

(*Trifolium incarnatum*).

BY HERBERT J. RUMSEY,
Boronia, Barber's Creek.

Of all the fodder-plants that have been prominently brought before the public of recent years, there is probably none that has taken a settled place in agriculture so quickly, where it has been tried, as Crimson Clover. In one State in America alone it was officially estimated two years ago that 12,000 acres were planted with it. During last year I obtained a quantity of seed, and not only planted it myself, but distributed it throughout the colony to be tested by others, and the result has far surpassed my expectations.

Crimson Clover is a winter-growing annual, and should be planted in late summer or early autumn. During the winter it sends a well-branched fibrous root right down into the subsoil, and at the same time makes a fair amount of top growth; but it is not until the end of September or beginning of October that it makes most of its growth. Just about the last week in September it begins to stool out, and in a few weeks the ground is covered to a depth of 16 to 18 inches or more with a dense mass of succulent fodder, much enjoyed by any stock that can get a taste of it. Each root sends up from twenty to forty stalks, terminating in a beautiful crimson (or scarlet) flower, which, if the action of the bees is any criterion, contains a very large amount of honey. It seeds very freely; as much as 14 bushels have been obtained per acre, but the average is about 5 bushels.

The time for planting is from January to March, or in some districts it would be possible to plant later. The object is to get the plants well started, with the root down into the subsoil, before the cold of winter comes. If planted early it will give a nice crop to be grazed off in the winter. This will improve rather than retard the spring growth, probably through the extra root formation being induced by the tops being eaten down. For this purpose, if about 1 lb. of turnip-seed is mixed with 10 lb. of clover-seed for an acre, it will be found an improvement, the turnips sheltering the clover in its young state from the hot sun. If it is not required for grazing, the turnips can be pulled when mature and the clover left in possession.

The principal points of value in this crop are:—1st. That it is a nitrogen-gatherer, obtaining most of its food from that cheap source, the air, and it relies principally on the subsoil for its supply of mineral food, bringing it from where it is out of the reach of shallower-rooting plants, and not only gathering these together for its own necessities, but leaving a large portion of them in its decaying stubble and roots in the best of form and position

for succeeding crops. 2nd. That all this is done at a time when the land would be otherwise idle, and without losing the use of the land for the regular crops. To make the best use of this it can be planted after, say, early potatoes, and will be ready to cut for hay, green feed, or ensilage in time to plough for corn or late potatoes next season. Our American friends very often sow it from horseback in standing corn after the cultivator has been through for the last time, then cut it in time to put in corn again the next season; although such a short rotation is not to be recommended, the crop of corn in the second season will show the value of the clover.

By a systematic use of clover poor or run-down land can be brought to a high state of fertility.

A dressing of potash in the form of sulphate or kainit would prove valuable in helping the clover to a start, especially on sandy soils, and if a little superphosphate were added, so much the better. The best commercial mixed fertiliser that I know of for this purpose is Sugar Company's No. 6.

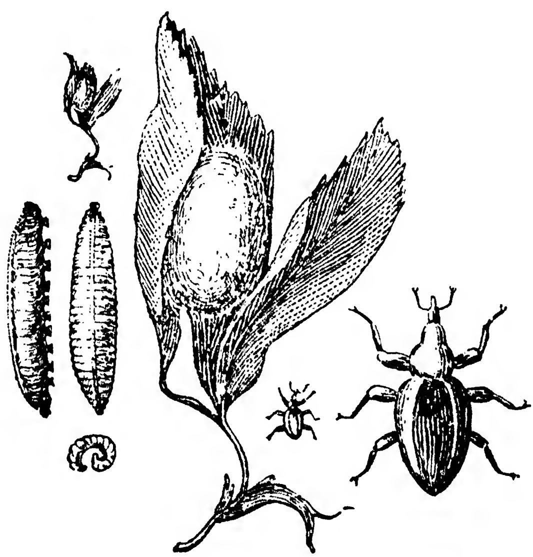
The land should be thoroughly prepared before planting, and the seed (about 10 lb. or 12 lb. to the acre) very lightly covered with a brush-harrow, or if sown before a shower, it will require no other covering.

A Great Destroyer of Lucerne.

(The *Hyperia murina.*)

The following extract from the *Journal de l'Agriculture*, Paris, 17 October, 1896, may be of interest to our lucerne growers:—

"We have received information from different parts of the Rhenish provinces that during this summer the lucerne has been tremendously damaged by a small caterpillar. In certain places the ravages have been such that only the bare stems remain. In the district of Poppelsdorf the caterpillar was noticed on the first crop, and then in far greater numbers on the 5th and 6th July, or about the time of the second harvest. Twenty of these caterpillars were put in a glass and after two or three days they began to enclose



Hyperia Murina. The worm, natural size.—Enlarged view of the back side view.—The developed insect, natural size and enlarged.—Cocoon on a leaf, natural size, and enlarged. (Reproduced from an illustration in above Journal).

themselves in cocoons similar to those which they make between the leaves. These cocoons are of the size of a pea, and the caterpillar is inside. Thirteen days after the cocoon is begun there comes out a small coleoptera which at once attacks the tender grass. It only devours the leaf between the veins, digging into the soft part of the stalk with its proboscis to extract the juice,

and occasionally devouring the upper part (of the stalk), which then gets covered with brown spots. This coleoptera passes the winter under leaves, moss, stones, &c. The female lays its eggs in May, on the tender lucerne, which is speedily devoured. After a few days, green larvæ are developed which keep by preference to the extremities of the shoots, where they feed on the smallest and tenderest leaves. They cast their skin three times, from eight to twelve days apart. The last time they weave a little nest of oval shape, resembling a white silk mesh, which adheres strongly to the main stalk. It is in this retreat that they transform themselves, during nine to twelve days, and from which they come out at the end of a fortnight. All the changes take place close upon each other.

"The damage caused by these injurious insects, which multiply rapidly, is very serious, as up to now, no radical means of destroying them has been found, and it requires all one's best endeavours to keep them within bounds. The caterpillar and the coleoptera are very difficult to get hold of, as they fall off at the least movement of the plants, and particularly when the grass is mown. But the cocoons adhere strongly to the stalks, and, at each stroke of the scythe, a generation of worms falls, and if you could wait to mow until most of the worms have woven their cocoons, it would be easy to destroy a large number. This means of destruction would be still easier if the lucerne were eaten green, but this is of course impossible most of the time, as it is the dried lucerne which you wish to have. The worms are about three-eighths of an inch long, and a clear brown colour in the early stages, and a light green afterwards. A very distinct yellow line exists on the back; the body has 10 legs, and is covered with very short stiff hairs; the head is dark brown.

"The coleoptera is 5 to 6 millimetres long (say under ¼ in.), and has a proboscis 2 millimetres long, of cylindrical shape turned downward. On the sides of the head are strong antennæ. The back of the coleoptera has also a dark brown line extending to the two extremities. This dark line divides the wings, which are of a light brown colour, with delicate lines of brown and yellow."

How to Trench Land properly.

W. S. CAMPBELL.

It is remarkable that well-trenched land is but seldom seen. The general rule is to simply turn over the ground 2 feet deep—topsy-turvey, in fact. No matter how poor, hard, or indifferent the subsoil may be, it is brought up to the top, the idea often being that the roots of plants will be all the better if the best part of the soil be buried deep beneath the surface. At the same time but very few persons have a knowledge of the proper method of trenching, so that the top or surface soil can be kept on the top, no matter how deep—2, 3, or 4 feet—the ground may be trenched.

It is the simplest thing in the world to do when you know how, like many other things which remain mysteries until explained.

As I, fortunately, had a thorough practical training under skilled and competent gardeners, I learnt early in life the practice I shall now endeavour to make as clear as possible.

If you have a portion of land to trench, the first thing you should do is to divide its width into two, four, six, eight, or more equal parts, and you will presently see the reason for doing this. The diagram (Fig. 1) shows the divisions A and B. Make these divisions as accurately as you can. If your land is irregular, you must endeavour to divide it up into blocks as evenly as possible. Now the two blocks which we call A and B must be divided into lands, either 2 or 3 feet in width. I have found in practice that 3 feet is the best width especially if the soil be dry and crumbly; for with a width of only 2 feet it is difficult to keep the soil in place during the operation of trenching. The dividing and marking of a block of land can be done very quickly, but it must be done accurately.

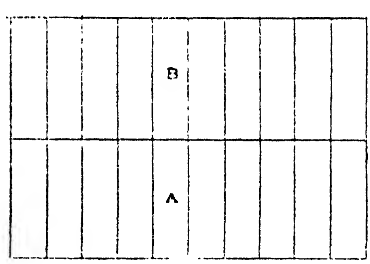


Fig. 1.

I may state that one of the handiest articles to have about a place is an ordinary mason's iron square. With this, one can lay out work with great accuracy. If you wish to square off a block of land, all you have to do will be to lay the square on the ground in the direction required, fix a peg at the corner of the outside angle, and stretch your line from the peg

along the side of the square; mark this, and then stretch along the other side and mark. (Fig. 2.) Simple as this may now appear, it is surprising how few employ it or know anything about it.

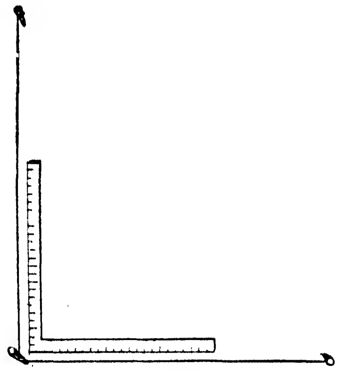


Fig. 2.

Adopt any means you please to mark out the lands, either by pegs at the corner when a line can be stretched from peg to peg as the work proceeds or else by a little furrow made by pickaxe or hoe, or any other way convenient so long as it be accurately done.

After these little, but very necessary, preliminaries have been completed the trenching begins, and the diagram below (Fig. 3) will greatly assist my work of explanation.

Supposing the depth to be trenched is 2 feet, dig out the top soil of division 1 and the top soil of division 2 to a depth of 1 foot, and carry this away in a wheelbarrow to the end of block D as shown, and keep it in a heap by itself; then dig out the bottom soil of division No. 1 only, and wheel this close to the top soil, but keep this also in a heap by itself. Be sure when you dig out the bottom or subsoil that you keep the floor quite level; of course, following the general contour of the surface. When the whole of block 1 has been emptied of its soil to the required depth, dig out the bottom soil of No. 2, and throw it out into the bottom of No. 1. It will thus have a complete turning over, and, consequently, complete aëration. Be careful not to let any of the soil fall back into the bottom of No. 2 as

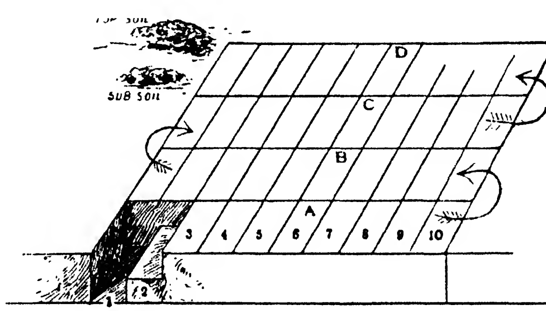


Fig. 3

you dig. You will find that this soil will rise, especially if dry, almost to the top of No. 1; keep it level, and pack the side with your spade to keep it in place. When the bottom soil of No. 2 has been transferred to No. 1, transfer the top soil of No. 3 to the top of No. 1, then the bottom soil of No. 3 to the bottom of No. 2, and so on to the end of block A. When you come to this you must turn to block B, as shown by the arrow, then from block B to block C, and from C to D. When you arrive at the end of D, you will require sufficient bottom soil to fill one trench and two top soils to

complete the work. These you will find in the two heaps taken from the first two divisions.

You will see now the advantage of dividing into two, four, six, eight, and so on, for if you divide into three, six, nine, you would have to wheel the soil a considerable distance, and a good deal of time and labour will be saved.

The great secret is to work accurately, but if you are a beginner at trenching you will find some difficulty at first in keeping the soil from tumbling back into the trench, and also in keeping the bottom properly level. This latter is more important than it may seem at first sight, for if not well done the draining is likely to be defective, and good and proper drainage is of the greatest importance.

Whilst trenching, you might take the opportunity, if your soil or subsoil is poor, of mixing with it some manure, either farmyard or bone-meal, or some complete artificial manure.

Government Prizes for Exports.

Royal Agricultural Society's Easter Show.

The Hon. Sydney Smith, Minister for Mines and Agriculture, on the advice of the Board for Exports, has decided to offer, at the Easter Show of the Royal Agricultural Society, a list of valuable prizes for exportable produce, the schedule of which is as follows:—

A.—Butter for Export.

Prize, £50—Best exhibit of five boxes Butter, suitable for export.

Conditions of Competition.

1. Each exhibit shall consist of five boxes butter, each of 56 lb. net weight.
2. No exhibitor shall compete with more than one exhibit.
3. The boxes must be of the latest type of export box, hollowed out to allow circulation of air. Samples of this class of box may be seen at the office of the Secretary, Board for Exports, 40, Young-street, City.
4. The boxes must not bear any distinguishing brand or mark—the necessary labels may be procured on application to the Secretary of the Society.
5. All exhibits competing in this section must be stored in the Government Refrigerating Depôt at least six weeks prior to date of Show.
6. Each exhibit shall be sealed by the official in charge of the Depôt, and the seals shall be broken by the Judges at the time and place of judging.
7. In all other particulars the exhibits shall be subject to the By-laws and Regulations for the Society's Exhibition.

B.—Poultry for Export.

First prize, £10; second, £5—Best exhibit of two cases each, Ducks and Fowls, suitable for export (twenty birds in each case), packed for export.

Conditions of Competition.

The birds must be killed, dressed, wrapped, and packed, and must be stored in the Government Refrigerating Depôt at least six weeks prior to date of Show.

Particulars as to export cases may be had on application to the Secretary, Board for Exports.

C.—Sheep for Export.

I.—Best exhibit of twenty-five Merino Wethers, not exceeding six-tooth. First prize, £20; second, £5.

II.—Best exhibit of twenty-five Cross-bred Wethers, not exceeding four-tooth. First prize, £20; second, £5.

III.—Best exhibit of twenty-five Merino Lambs, Suckers, not exceeding five months. First prize, £15; second, £5.

IV.—Best exhibit of twenty-five Cross-bred Lambs, Suckers, not exceeding four months. First prize, £15; second, £5.

Conditions of Competition.

1. All exhibits in this section must be the *bona-fide* property of exhibitor at time of Show, and for twelve months previously in case of sheep. Lambs must be bred by exhibitor.
2. No exhibitor shall compete with more than one exhibit in each sub-section.
3. The sheep shall be judged alive (by points), and, on the third day of Show, slaughtered and judged in carcase. (Two sheep from each pen shall be slaughtered on second day of Show and exhibited in pen). The exhibitor getting the highest aggregate number of points to be declared the winner.
4. The Judges shall take into consideration the quality and weight of carcase best suited for export, but in case of a tie then the value of skin and fat shall be taken to decide the tie.
5. In case of absolute equality, then the preference to be given to the youngest sheep.
6. Evenness of quality and weight shall be considered in awarding the prizes, the range suggested being:—For merinos, 52 lb. to 58 lb., average, 54 lb.; or, small merinos, 47 lb. to 52 lb.; average, 49 lb. Cross-breds, 55 lb. to 65 lb.; average, 58 lb. (Net freezing weights.)
7. Exhibitors shall declare on entry form that the sheep have been grass fed.
8. All exhibits considered fit for export shall be killed, frozen, and shipped to London under the supervision of an expert appointed by the Board for Exports, and there sold by public auction and reported on by qualified experts—the net proceeds, after deducting expenses, to be the property of exhibitor.

D.—Wheat for Export.

First prize, £15; second, £10—Best exhibit of Wheat, four-bushel sack, representing a bulk of not less than 100 sacks suitable for export. Grower to sell 100 sacks equal to exhibit by public auction during Show, if called on to do so by written notice delivered through the Secretary, and, failing to supply such quantity of equal sample, to forfeit any prize which may have been awarded.

E.—Barley for Export.

First prize, £15; second, £10—Best exhibit of Barley suitable for malting, four-bushel sack, representing a bulk of not less than fifty sacks suitable for export.

Conditions—Same as those for wheat.

F.—Bacon and Hams for Export.

First prize, £10; second, £5—Best exhibit of twenty Hams and twelve sides Bacon suitable for export.

Conditions of Competition.

I. The hams to be cured, smoked, wrapped, and packed in suitable case for export. The bacon to be green cured and packed in suitable case for export.

II. All exhibits to be stored, at even temperature, under the direction of Board for Exports, at least six weeks prior to date of Show. Cases to be sealed by the official in charge of the depôt.

G.—Meats and Soups for Export.

First prize, £10; second, £5—Best exhibit of six dozen tins Colonial Meats and Soups suitable for export, assorted.

H.—Fruit for Export.

First prize, £10; second, £5, in each section.

I. Best exhibit of not less than ten distinct varieties Dried Fruits, suitable for export, packed in cases of not less than 28 lb. each.

II. Best exhibit of not less than twenty-four distinct varieties Preserved Fruits, in syrup, suitable for export, packed in glass jars of not less than two quarts capacity each.

I.—Rabbits and Hares for Export.

(For New South Wales produce only.)

First prize, £10; second, £5—Best exhibit of twenty-four Rabbits and twenty (or nineteen) Hares packed for export.

Conditions of Competition.

The animals must be packed in proper export cases, particulars of which may be obtained from the Secretary, Board for Exports, and lodged in the refrigerating depôt at least six weeks prior to date of Show.

NOTE.—In all the foregoing classes, no prizes are to be awarded to exhibits which are not, in the opinion of the Judges, suitable for export as fairly representing what the Colony can produce. All exhibits of butter, poultry, hares, and rabbits shall be sold by public auction during Show, and the proceeds, after deducting expenses, handed to exhibitor.

It has long been a matter of comment that the conditions attending the awarding of prizes at our Shows were not such as to encourage the legitimate producer of a commercial article, but rather to favour specialists who made a business of exhibiting, and who acquired by all sorts of means certain standard samples, against which the average grower could not compete.

The present conditions are, as far as possible, framed to suit people who actually produce the goods and who are interested in the possibilities of our export trade.

The competition has been thrown open to all the Australasian colonies, so that our producers might have the opportunity of trying conclusions with those whom they have to meet and compete with in the world's markets, it being certain that, if we cannot hold our own at home, we have something to learn before we can successfully compete abroad.

The success of the intercolonial butter competition of last year encourages the anticipation that the prizes now offered will result in bringing out our local producers, and it is to be hoped that our own representatives will benefit from past experiences, and secure for this Colony the bulk of the prizes.

(Signed) JAS. STEPHENSON,
Secretary, Board of Exports.

Orchard Notes for February.

G. WATERS,
Orchardist, Hawkesbury Agricultural College.

The orchard work for February is very similar to that of January as regards the marketing of summer fruits. This month many of the best varieties of peaches for canning and drying are ripening. Every grower should see that nothing is wasted. Fruit intended for drying should always be ripe, for when perfectly so it contains a greater amount of saccharine (sugar), and consequently gives a greater percentage of dried fruit to green. At the same time it must be understood that it should not be over-ripe, else it will not keep its form when cut. Immediately after cutting it should be sulphured, not to give it a colour, as is usually thought, but to prevent it from discolouring, every person knowing that as soon as fruit is broken or cut it soon turns brown. If this is allowed to take place no amount of sulphur or anything else will make the natural colour return. Apples, especially, are liable to discolouration, and as these are sliced they should be dropped into a vessel containing water diluted with salt.

For drying purposes the slipstone peaches are the best. When dried (it is not possible to give elaborate directions under this head) see that the fruit is neatly packed, if intended for sale, as any extra care used in giving it an attractive appearance will be amply repaid, the public demand being a neatly-prepared article.

The clingstone peaches are the best for canning, being of a firmer texture, and so keep their shape better when cooked.

I cannot understand why our Central Cumberland fruit-growers, at any rate, are so apathetic on the question of drying. Tons of apricots that would have made a very presentable dried product were allowed to rot upon the ground. This year, on account of the good drying weather just at the time the main crop of apricots was ripening, all of this fruit could have been dried in the sun.

One thing that must not be neglected is spraying, especially the citrus trees. Just at this time the young scale insects are being hatched, and unless carefully watched will soon spread. It is while in a young state that they are most readily killed; indeed it is so much waste spray if put upon the wholly-developed scales, as they are so hard that scarcely any emulsion will kill all of them. The systematic watching of the hatching and the application at the right time should be the motto of the fruit-grower, especially the citrus fruit-grower.

Nothing looks more unsightly than the class of oranges and lemons that are sometimes put upon the Sydney market, and all because the growers will not attach the importance to spraying that is necessary. It is almost impossible to find any district that is entirely free from the various species of scale insects, which are being allowed to increase without any attempt to check them.

Do not go into the matter half-heartedly. An absolute necessity upon every orchard is a spray-pump. It is no use being niggardly; buy the best; it will be found to be the cheapest in the end. The old method of carrying a bucket round and drenching a tree with a syringe is not of the slightest use. Not only from an economic, but also an effectual, standpoint is the application of any spray in as light a form as possible necessary.

The aim should be to apply it just like a mist, as in this way all that is applied remains on the tree.

According to the size of the orchard so must be the size of the pump or pumps. The best one is the Nixon Climax, made in three sizes, No. 3 being the one that is mostly required. Attached to this one are two hoses, so that the work can be done quickly. The time suitable for spraying is so limited that the operation must be performed expeditiously; the early morning and late in afternoon being the best time during the summer, unless nice cloudy days occur, when it can be carried on all day.

For the generality of scale insects the kerosene emulsion is the most effectual, but great care must be used in the making, and also while the spray is being applied. See that it is thoroughly emulsified, and kept so during application. The formula for this has been given in the Agricultural Gazette at different times, but I will give it here again:

2 gallons kerosene
6 oz. soft-soap
1 gallon boiling water.

Put soft-soap into water, and when thoroughly dissolved add the kerosene, and keep stirring fast for ten minutes, when the kerosene will be mixed with the water; add water to make up 30 gallons. In order to make emulsion more efficacious, instead of adding pure water add water boiled and thickened with flour. This makes the mixture more adhesive. This also causes the fumagine, or black smut, to fall off in flakes.

A good method of mixing the emulsion is to pump it through the pump for about ten minutes, and an agitator fixed to the pump keeps the emulsion thoroughly mixed while applying. Another very good spray for citrus trees is the resin wash, which has also been given many times in the Agricultural Gazette; but I prefer the kerosene, the ingredients for which are more easily procured.

Cultivation must be closely attended to. Do not allow an opportunity of putting the cultivator in the orchard to pass.

Vegetable and Flower-growing.

Directions for the Month of February.

Vegetables.

Bean (French or Kidney).—Sow largely in warm districts, but do not sow much seed in cold climates.

Beet, Silver.—Sow a small quantity of seed in rows, and afterwards thin out.

Beet, Red.—Sow a little seed.

Borecole or Kale.—Sow seeds in beds or boxes.

Broccoli.—Sow a little seed.

Brussels Sprouts.—Sow a little seed.

Cauliflower.—Sow a little seed. Transplant from seed bed. Manure heavily.

Cabbage.—Sow a small quantity of seed. Plant out a few plants from time to time.

Carrot.—Sow small quantity of seed in drills. Thin and weed well.

Kohl rabi.—Sow a few seeds, transplant when the plants are large enough.

Lettuce.—Sow small quantity of seed in drills in the garden. When plants are strong enough thin out to about 8 inches to 1 foot apart.

Maize Sweet.—A few seeds may be sown, but in warm districts only.

Peas.—Sow a few rows in the cool districts.

Potatoes.—Plant a few rows.

Raddish.—Sow a few seeds from time to time in drills.

Red-beet.—Sow a few seeds in drills.

Savoy Cabbage.—Sow a little seed in drills.

Tomato.—Plant out a few plants in warm districts only.

Flower Garden.

Bulbs.—Raise any bulbs that may have lost all their leaves, and store away in a dry place, or if left in the ground, mark the spots where they are growing.

Roses.—May be pruned back and seed vessels removed. Young pot roses may be planted, but they shall be watered and shaded we'l. Budding may be carried on.

Chrysanthemums.—Should be well watered and supplied once or twice a week with liquid manure.

Dahlias.—Should be well watered and be supplied occasionally with liquid manure.

Flower Seeds.—Should be gathered and carefully preserved as they become ripe.

General Notes.

Seeds for Distribution.

Marram Grass. *Psamma arenaria* (Syn. *Ammophila arundinacea*).—The well-known sand-binder, figured and described in the *Gazette* for January, 1895.

"Florida Beggar-weed." *Desmodium tortuosum*, Sw.—A highly-esteemed wild forage-plant of the sub-tropical United States. Yields fodder of fine quality on sandy soils containing lime. Grows 8 to 10 feet high under cultivation.

The Director of the Botanic Gardens informs us that he has a small quantity of fresh seeds of the above plants available for distribution to applicants in suitable localities who, will undertake to report as to the result of their experiments with them.

Hawkesbury Agricultural College Travelling Scholarship.

In connection with the Travelling Scholarship, which comprises a two years' course of instruction at one of the leading American Agricultural Colleges, recently offered by the Minister for Mines and Agriculture, it has been decided that the examination shall be held in Sydney on 8th March, 1897, and shall be open to all who have taken their diploma at the Hawkesbury Agricultural College.

The subjects of examination will be the science and practice of agriculture, chemistry, botany, entomology, vegetable pathology, veterinary science, and surveying and mensuration, and questions will be based on the syllabus of instruction adopted at the Hawkesbury College.

The selected candidate will, at the termination of his course, be expected to return to the Colony, and if required take up the duty of instructor or other suitable work under the Department of Agriculture for a period of three years at a salary commensurate with the nature of the work.

In making the selection, due regard will be paid to the general fitness of the candidate in addition to educational qualifications.

Visitors to Experimental Farms.

It has been the practice for some time for farmers and fruit-growers to organise parties to visit the different experimental farms of the Department, and the Minister, recognising the educational advantages of such excursions, decided that facilities should be afforded so as to enable as many farmers and fruit-growers as possible to avail of the instruction that inspection of the farm provides. The Railway Commissioners were approached on the subject, and they have now authorised the Department to issue certificates to parties of not less than six persons to enable them to travel to and from the farms at single fare for the double journey.

Forcing Potatoes to Sprout.

Mr. H. L. White, of Belltrees, Scone, asks for information as to the best method of forcing seed potatoes to shoot. He says, "I wish to use potatoes dug now for planting towards the end of January."

The following reply has been furnished by Mr. A. A. Dunnicliff (Department of Agriculture) :—The undermentioned method has been practised by me for years, and found as expeditious as any, for forcing freshly dug potatoes into sprouting for seed purposes :—

Put the tubers in a heap and let the wind go through them for the purpose of taking off internal moisture and maturing them. Whilst doing this they may be exposed to the light until green, with advantage. If on the earth, and in the open, so much the better. They may then be covered up with bags or earth, and kept moist or steamy with water, if necessary, until they sprout, which will be in ample time for planting the autumn crop.

Pasture Grasses for Inverell District.

The following reply furnished by Mr. A. A. Dunnicliff to a request for information concerning grasses suitable for a part of the Inverell district (basaltic formation, varying from stiff chocolate to very light red dusty soil) may be of interest:—

The selection of grasses for the soil, climate, and purposes of Mr. H. B. Cooper, of Stirling, Inverell, must be confined to those common to the Northern Hemisphere, or exogenous grasses, inasmuch as seeds cannot be obtained in quantity of any indigenous ones likely to be of service to him. Several of the former are highly suitable in the present instance, and to the Inverell district generally.

I would recommend that *Lolium perenne* (Perennial Rye grass) and *Dactylis glomerata* (Cocksfoot) form the basis of his pasture ; to which may be added, *Poa pratensis*, or smooth stalked meadow grass (in America called Kentucky Blue grass) and *Poa trivalis* (rough stalked meadow grass), if fresh seeds of the latter two can be obtained. Prairie grass, *Ceratochloa unioliodes*, is a valuable and nutritious grass which should also be included, together with a little *Plantago lanceolata* (Rib grass) and *Trifolium repens* (White Dutch Clover).

A mixture of the above might be sown in the following proportions :—

Perennial Rye Grass	20 lb.
Cocksfoot Grass	7 lb.
Smooth Meadow Grass...	3 lb.
Rough Meadow Grass	3 lb.
Prairie Grass	7 lb.
Rib Grass	2 lb.
White Clover	1 lb.
Mixed Clovers	1 lb.

Besides these, there are several other grasses likely to be of great service in that district, and well worthy of trial by any progressive farmer or grazier. For instance, *Phleum pratensis* (Catstail), or Timothy, as it is called in America, is a nutritious and luxuriant grass, valuable alike for pasture or hay ; *Cynosurus cristatus* (Crested Dog's Tail) is another favourite which, being deep-rooted and forming a compact turf, is a useful addition to the pasture where the soil is light or the climate dry ; *Alopecurus pratensis*

(Meadow Foxtail) is one of our earliest and best pasture grasses, but as it does not come to its perfection until the second or third year it is not included in the mixture named, which should be in full work the first year after sowing; *Festuca pratensis* (Meadow Fesque), *Festuca ovina* (Sheep's Fesque) and others, besides several clovers, are also worthy of being sown.

All the grasses mentioned herein are rich in nutriment, and will be found hardy and free growers, luxuriating in the climate and soils of Inverell district.

Pickled Cherries.

A most beautiful preserve for use during the summer months after the crop of cherries is done is made as follows:—6 lb. cherries, 6 lb. sugar, ¾ pint vinegar.

Place all the ingredients into preserving pan and boil slowly till the cherries wrinkle; when cold, bottle and seal down securely.—G. Waters.

Crystallized Peaches.

These are probably the most delicious of preserved fruits, and are treated in the following manner. It may be mentioned that the yellow clingstone peaches are the best for the purpose:—Pare and cut the peaches into halves removing the stone, this operation being easily done with a pitting spoon, obtainable at several places in Sydney. To 6 lb. of fruit allow 2 lb. of sifted sugar for the sprinkling. Make a syrup of ¾ lb. of sugar and a little water; when it becomes hot put in the peaches. Let them remain cooking till quite clear, but not to become red. Take them carefully out, spread on broad dish, and set in the sun to dry, covering with mesquito netting to keep off insects. Strew some fine sugar over them, not too much at a time or it will bring out the syrup too fast. If syrup does not form remove peaches to a dry dish. When they begin to look dry sprinkle some more sugar, and when quite dry place them in jars with a layer of sugar between two layers of fruit.—G. Waters.

The Farmers' and Fruitgrowers' Guide.

(468 *pages, illustrated.*)

This book, which deals exhaustively with every branch of farming and fruit-growing, is now obtainable at the Government Printing Office. Price 1s. paper and 3s. 6d. clothbinding.

AGRICULTURAL SOCIETIES' SHOWS, 1897.

Society.	Secretary.	Date.
Dapto A. and H. Society	A. B. Chippindall	Jan. 6, 7
Albion Park A. and H. Association	H. Fryer ...	,, 13, 14
Gosford A. and H. Association	W. McIntyre ...	,, 29, 30
Wollongong A. and H. Society	J. A. Beatson ...	Feb. 3, 4
Cobargo A., P., and H. Society	T. Kennedy ...	,, 16, 17
Ulladulla P. and A. Society	C. A. Cork ...	,, 16, 17
Berrigan A. and H. Society	R. Drummond...	,, 17
Riverina P. and A. Society (Cereal)	W. Elliott ...	,, ——
Manning R. (Taree) A. and H. Association	H. Plummer ...	,, 18, 19
Lithgow A., H., and P. Society	J. Asher ...	,, 18, 19
Robertson Agricultural Society	R. J. Ferguson .	Mar. 2, 3
Bega A., P., and H. Society	J. Underhill ...	,, 3, 4
Southern New England (Uralla) P. and A. Association	Jas. Leece ...	,, 9, 10
Tumbarumba P. and A. Society	W. Willans ...	,, 9, 10
Tenterfield Intercolonial P., A., and M. Society ...	F. W. Hoskin ...	,, 10, 11, 12
Oberon A., H., and P. Association	A. Gale... ...	,, 11, 12
Berrima District (Moss Vale) A. H. and I Society ...	J. Yeo	,, 11, 12, 13
Cobargo A., P., and H. Society	T. Kennedy ...	,, 16, 17
Crookwell P. and A. Association	W. P. Levey ...	,, 18, 19
Lismore A. and I. Society	T. M. Dewitt ...	,, 18, 19
Walcha P. and A.	F. Townsend ...	,, 23, 24
Cudal A. and P. Society	C. Schramme ...	,, 24, 25
Blayney A. and P. Association	J. Clements ...	April 1, 2
Mudgee A. P. H. and I.	J. Cox	,, 6, 7
Liverpool Plains (Tamworth) P., A., & H. Association	A. M'Leod ...	,, 6, 7, 8
Warialda P. and A. Association	W. B. Geddes...	,, 7, 8
Williams River A. and H. Association	W. Bennett ...	,, 7, 8
Cooma P. and A. Society	D. C. Pearson ...	,, 7, 8
Orange A. and P. Association	W. Tanner ...	,, 7, 8, 9
Royal Agricultural Society	F. Webster ...	,, 14–20
Moree P. and A. Society	S. L. Cohen ...	,, 21, 22
Hunter River (West Maitland) A. and H. Association...	W. C. Quinton .	,, 28, 29, 30
Hay Hortic. Society...	J. Johnston ...	May 5
Upper Manning A. and H. Society	W. Dimond ...	,, 12, 13
Upper Hunter P. and A. (Muswellbrook)	J. C. Luscombe	,, 19, 20, 21
Northern Agricultural Association	C. Poppenhagen	Sept. 1, 2

Secretaries of Societies are asked to forward dates of forthcoming Shows as soon as decided.

[6 plates.]

Useful Australian Plants.

By J. H. MAIDEN,
Government Botanist and Director of the Botanic Gardens, Sydney.

No. 35—The Comb-like Wheat-grass (*Agropyrum pectinatum*, Beauv).

Botanical Name.—*Agropyrum* (more properly *Agropyron*), Greek, *Agros*, a field; *puros*, wheat, owing to the resemblance of these grasses to wheat.

Pectinatum, Latin, like a comb, in allusion to the appearance of the inflorescence.

Synonym, *Triticum pectinatum*, R. Br.

Vernacular Name.—I do not know any vernacular name actually in use for this grass. The rather clumsy name suggested for it may serve provisionally.

Botanical Description (B. Fl. vii, 666).—Stems from under 1 foot to 1½ feet high.

Leaves chiefly at the base of the stem, narrow, flat, usually hairy.

Spike raised on a long peduncle, 1 to 3 inches long, the rhachis pubescent, not notched.

Spikelets not very distant, spreading, or at length reflexed, mostly about ½ inch long, including the short points, 3 to 6-flowered.

Glumes spreading, the two outer empty ones shorter, with only the midrib or 3-nerved.

Flowering Glumes 4 to 5 lines long, rigid, 3 or 5-nerved, tapering into a rather long pungent point.

Value as a Fodder.—We know very little about its value in this respect, and I would ask residents of the districts in which it grows to give it more attention. It produces a fairly leafy bottom, and is probably eaten by stock with the other grasses when young, but while still perfectly green and only in inflorescence. I have seen acres of pasture in which it preponderates with scarcely a spike bitten off. Nevertheless, arguing from analogy, it is probably a nutritious grass.

We have three species of *Agropyrum*, and they are peculiar to Australia, with the exception that *A. scabrum* extends to New Zealand. We know so little about the genus from Australian experience, that perhaps a few notes of the experience of other countries in regard to other species of *Agropyrum* may be of some use. I quote from Vasey's "Agricultural Grasses and Forage Plants of the United States" (1889).

A. tenerum occurs mostly in low, moist ground, grows in clumps, and is one of the best grasses for hay.

A. repens (Couch-grass of the United States; Quack-grass). "The farmers of the United States unite in one continuous howl of execration against this grass, and it seems strange, when every man's hand is against it, that it is not exterminated. Yet we could never really satisfy ourselves that its presence in meadows and pastures was such an unmitigated curse. In lands where alternate husbandry is practised it must be admitted to be an evil of great magnitude. Its hardiness is such, and its rapidity of growth so great, that it springs up much more rapidly than any crop that can be planted, and chokes it; still, this grass has many virtues. It is perfectly cosmopolitan in its habits. It is found in all sorts of soil and climates. Its creeping roots are succulent and very nutritive, and are greedily devoured by horses and cows."

Of *A. glaucum* (Blue stem or Blue joint), considered by some to be a variety of the preceding, Professor Scribner writes: "It is the most highly praised of the native grasses for hay. Wherever it occupies exclusively any large area of ground, as it does frequently in the lower districts, especially near Fort Benton, it is cut for hay. Naturally it does not yield a great bulk, but its quality is unsurpassed. After two or three cuttings the yield of hay diminishes so much that it is scarcely worth the harvesting. It is then customary to drag a short-toothed harrow over the sod, which breaks up the creeping roots or underground stems, and each fragment then makes a new plant."

Habitat and Range.—It is confined to New South Wales, Victoria, and Tasmania. In New South Wales it is common in many parts of the Monaro, chiefly on black soil flats, often in swampy land. It ascends to high altitudes (I have it from 5,000 to 6,000 feet on Mt. Kosciusko). In Victoria it is confined to Northern Gippsland, in situations similar to those it frequents over the Border in the northern colony. In Tasmania it is found in the Hampshire Hills, Thomas Plains, and Recherche Bay.

Reference to Plate.—A, spikelet; B, empty glume; C, back and front views of seed; all enlarged.

(116 32-97.)

Agropyrum pectinatum.

"The Comb-like Wheat Fern."

The Weeds of New South Wales.

SUPPLEMENTARY NOTES. No. 4.

[Previous reference, 1896, 428.]

J. H. MAIDEN.

CRUCIFERÆ.

SHEPHERD'S PURSE. (*Capsella bursa-pastoris*, Mœnch.)

MR. H. A. LOWE writes from the Mudgee District. "I send you a specimen of a weed which has made rapid strides in this district during the last four years, and has made such an abundant growth this year as to almost destroy the lucerne patches. Many farmers assert it came through wheat distributed by the Government some years since. The seed was from New Zealand, and the weed is commonly called 'New Zealand Pest.'"

It is, of course, quite possible that a sample of seed-wheat distributed by Government a few years since contained this weed, but the plant was introduced into the Colony long ago. It probably arrived with or soon after the First Fleet, and is thoroughly acclimatised in many parts of the Colony, being often found by roadsides.

The statement in regard to its destructive effect on lucerne is serious, and may be read in conjunction with the following:—"With us it is an annoyance in gardens and a pest in fields, doing the greatest injury in fields of alfalfa (lucerne); it has been sent us from several localities with the report that it was running out alfalfa. That it is capable of doing this I have seen demonstrated in a road-side piece of alfalfa, which in three years has entirely succumbed to the encroachment of the Shepherd's Purse. . . . We rate the plant as one of our worst weeds." Nevada weeds, No. II (Bulletin No. 22), Decr., 1893.

In the *Gazette* for April, 1895, page 228, I made a note, "In some of the States of America it is not viewed with alarm, but in Colorado this weed is reported as doing great injury to alfalfa (lucerne), a fact which should be taken to heart by the farmers of the Hunter River and elsewhere."

In view of Mr. Lowe's report, attention is again invited to the matter, and correspondence is invited from lucerne growers.

It produces an enormous quantity of small yellowish seed which could readily be separated from lucerne seed by sifting. The only way to tackle it appears to be by hoeing it when in flower, or at any time before it matures seeds. In grass lands frequent mowings will destroy this pest.

RESEDACEÆ.

WELD OR DYERS' WEED. (*Reseda luteola*, Linn.)

Growing on unstocked country on Coree Station. This is a handsome mignonette, or rather, close relation to the mignonette. It affords a yellow

dye, and hence has been largely used for the purpose in Europe for many centuries, until the advent of chemical dyes.

It is useless, though ornamental.

COMPOSITÆ.

Pitch Weed. (*Madia saliva*, Mol.)

This has been sent from the Nundle district, with the following remarks:—"I am also sending a nasty-smelling plant which has just made its appearance in this district; it is as yet confined to a corner of the field. Will you kindly tell me what it is, and whether I should destroy it before it spreads." This plant is allied to the sunflowers, and it is a native of Chili. It has not hitherto been recorded from New South Wales, as far as I know, although Baron von Mueller records it from Victoria.

I have advised that it be treated as a weed, and eradicated. At the same time I give an interesting account by Gilbert H. Hicks, of the United States Department of Agriculture, who recommends it as a plant worth cultivating for its seed, which contains a considerable quantity of oil. By all means let it be cultivated in an experimental patch here, for this purpose, but, unless cultivated, let it be eradicated; it may become a nuisance. The plant spreads rapidly, and stock will not touch it.

"This plant is an annual, growing from 1 to 3 feet high, with a large mass of sticky, ill-smelling foliage and yellow flowers. The achenes are 6 to 7 mm. long, 2 to 2·5 mm. wide, and 1 to 1·5 mm. thick, slightly bow-shaped, broader at the upper end, gray in colour, the surface being ridged with fine, longitudinal lines. The seeds contain about 32 per cent. of a rich oil, which is used for food, making soap, and illumination, and is said to be as good for cooking purposes as olive oil, which it supersedes in some countries. The fact that it does not readily congeal makes madia oil valuable for lubricating machinery. Madia has been cultivated to some extent in France and Germany, and grows wild very abundantly in California.

"It flourishes on almost any kind of soil, and as it requires but three months to ripen may be sown late in spring if desired. The cultivation of madia is very simple, although, as in the case of other crops, it responds to good soil and tillage. In France it is sown broadcast from the middle of April to the middle of May on well-prepared mellow soil, about 20 pounds of seed per acre. The seed comes up in ten to twelve days, and as soon as the plants have made a stand they are thinned out, at the first hoeing they are again thinned to 1 foot apart. The crop is harvested within ninety to one hundred days after sowing.

"Harvesting takes place as soon as the seeds are well "set," without waiting for them to become thoroughly ripe as they shell out easily; moreover, they finish ripening after the plants are cut. Harvesting is done in France with a sickle. It is claimed that if properly cultivated and gathered madia will yield from 1,200 to 1,400 pounds of seed per acre, making over 20 gallons of oil. The plants should be thoroughly dried before thrashing.

"Madia could be successfully grown in California and other sections of the United States. The principle drawbacks are the disagreeable odour exhaled by the flowers, the greasy nature of the foliage, and the irregular ripening of the seeds." [Oil-producing Seeds, p. 195 of the Year-book of the United States Department of Agriculture for 1895.]

CAPE WEED. (*Cryptostemma calendulacea.*)

[Previous references, 1891, 505; 1895, 240].

This has made its appearance in the neighbourhood of Nowra, where it has created a small scare. It is one of those plants which will spread throughout the Colony unless eradicated on its first appearance in fresh localities.

VARIEGATED THISTLE. (*Carduus marianus*, Linn.)

[Previous reference, 1895, 234].

This thistle continues to engage attention as a forage-plant. Following is a Goulburn telegram, which appeared in the *Sydney Morning Herald*, a few months ago:—"A local firm of auctioneers has received from the Cooma district sample trusses of a new fodder. It is simply cabbage-thistle, cut young and pressed into bundles. The vendor says his cows give a larger yield of milk when fed on it than when fed on any other fodder." The "bundles" were bales weighing each 7 cwt., much too heavy for handling, and the fodder found no market for this reason. It should be used at once, as it will not keep, and should be given sparingly at first to cattle not used to it.

As an instance of the way in which it will produce hoven in hungry cattle which eat greedily of it, the following paragraph from the *Sydney Morning Herald* should be taken to heart:—"Mr. Dulhunty, Inspector of Stock at Dubbo, reports a heavy loss of cattle through gorging themselves with young variegated thistle when in a hungry condition. Out of a mob of 917 head, which were allowed to depasture on a river flat containing 250 acres, and on which this thistle had sprung up, no less than 100 head were affected, 30 of which died in a few hours. During the month of October other deaths of a similar nature occurred in this district in mobs of hungry travelling cattle. In one case there were 42 deaths in a lot of about 600 head, and in another instance eight head died in a mob of about 400."

HYDROPHYLLACEÆ.

Phacelia tanacetifolia, Benth.

A native of California and Texas, U.S.A., has been received from Mr. Reymond, M.P., as having made its appearance at Forbes with Californian wheat. It has been sometimes recommended as a bee-plant, and is occasionally cultivated for ornamental purposes, but it is apt to break bounds and become a nuisance. It is a Tansy-like plant, with purplish flowers.

SCROPHULARINEÆ.

GREY MULLEIN (*Verbascum Thapsus*, Linn.) and MOTH MULLEIN (*Verbascum Blattaria*, Linn.)

[Previous reference, 1895, 293.]

Observed to be very common (particularly the latter) in the Queanbeyan and Cooma districts. The latter has been also recently received from Byrock.

LABIATÆ.

VERVAIN SAGE OR WILD ENGLISH CLARY (*Salvia verbenaca*, Linn.)

[Previous reference, 1895, 299.]

Received from near Mudgee, where it appears to have been previously unknown. It is, however, well established in many of the cooler parts of the Colony. It is a worthless, spreading weed, but not poisonous.

White Cedar Berries.

[Previous references 1893, 583; 1896, 427, 564, 662.]

We have received from Mr. L. Pegum, Camperdown Farm, Brownlow Hill, Camden, the following letter. The communication of Mr. Loxton referred to appeared in the September, 1896, issue:—

"What Mr. Loxton states throws new light on, and in my opinion gives the key to, the solution of the question—Are the berries of the White Cedar poisonous? If birds eat them with impunity, if the green pigeon of the Richmond River grows fat on them, while at the same time pigs feeding on them die, it is evident* that results so widely different can only be caused by the manner equally different in which pigs and birds feed. The pigs crunch and masticate the berries, thereby freeing the kernel, which according to its properties is thus at liberty to act on the viscera. Birds necessarily swallow the berries whole, and do not digest the stones. Since birds are not affected, it may be safely inferred that the rind and fruity part are wholesome, and that if the berries are poisonous at all the poison is in the stone or kernel. But the pips or stones of all fruit contain prussic acid more or less, notably, the bitter almond, cherry, laurel, peach, and apple. In the peach the leaves also. Perhaps the stones of these cedar berries contain prussic acid in excess† of ordinary fruits, and may have a special value on that account. Thus the death of the pigs is easily accounted for, being poisoned by the prussic acid contained in the kernels, should they eat any considerable quantity of them, while at the same time birds digesting only the rind or fruity part may thrive and feed continuously on the berries with advantage.

"Of course, when it is stated that 'the seed forms hard lumps in the bowels, and thus kills,' it does not necessarily imply that the seeds are poisonous, only indigestible as far as that pig was concerned; another pig may have a more powerful stomach, or the state of health, age, condition, exhausted vitality through driving, &c., would make a great difference. I have seen an otherwise healthy sow die through eating three cobs of hard dry corn which were injudiciously given her immediately after farrowing.

"Without any doubt it is very undesirable, as, indeed, it is very unsightly in a township or school play-ground or public park, where children are playing about, to leave those berries on the trees or lying on the ground to tempt some youngster to an unwholesome feast, or to allure as a bait the unsuspecting porker, should he come fossicking round, to prematurely pay the penalty. The berries should be gathered when green, before they begin to fall, and cleared right off. The trees themselves, on account of their wealth of bloom, refreshing perfume, and grateful shade, are deserving every care and attention."

* Not necessarily. There is abundant evidence that some substances are poisonous to one kind of animal, but harmless to another.—Ed.

† It is an assumption that white cedar fruits contain prussic acid at all, but the matter will be referred to the chemist for settlement in due course.—Ed.

The Physiological Rôle of Water in Plants.*

EDMOND GAIN,
Professor of Agricultural Physiology and Chemistry, University of Nancy, France.

WATER plays an important rôle in the growth of plants, and if we consider the possibility of controlling its distribution by means of irrigation, the practical interest attached to an exact study of its function in plant growth becomes apparent.

The question is very complicated from a theoretical point of view. If considered merely from the side of application of water, there are many difficulties due to the varying requirements of each of our cultivated plants. While morphologically plants of the same or even different species may agree, the physiological characters are very dissimilar, and it often happens that the physiological requirements of varieties of the same species are totally unlike. By selection and hybridization we are enabled to produce races and varieties having very different characteristics. In the process of acclimatization certain secondary morphological characters are developed which are often retained by the plant in its struggle to adapt itself to its surroundings.

Gaston Bonnier,† of the University of Paris, has shown the convergence of morphological types under the influence of cold, due either to latitude or altitude, and that plants upon mountain tops and in polar regions have analogous structure.

J. Vesque‡ has established the fact that inherited characteristics have little to do with the adaptation of plants to drought and that there is no genus, however small, all the species of which are adapted in the same degree to a given physical environment. This biological principle is cited to show the necessity for repeated experimental research in order to elucidate the rôle of water in the growth of cultivated plants. Consideration of it will also prevent too hasty generalization from conclusions which pertain to a single species. Exact information is necessary as to the species under experiment, as well as the variety and race, also the country whence the seed, tubers, bulbs, &c., came. In regard to reproduction by cuttings, the writer does not believe there is an invariable transmission of ancestral characteristics. He thinks that the cutting will produce an individual subject to variation to just the extent that the new conditions of life prove more advantageous than the old. This applies equally to reproduction by grafts or from cuttings.

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* Experiment Station Record, Department of Agriculture, Washington, U.S.A.

† Rev. gén. Bot., 6 (1894), p. 505; Compt. Rend., 113 (1894), p. 1427.

‡ L'absorption de l'eau et la transpiration, Ann. Sci. Nat. Bot., ser. 6, vol. 4, p. 89; vol. 6, p. 169; vol. 9, p. 5.

A difficulty in physiological experimentation has recently been pointed out by Prof. Raulin,* of the University of Lyons. He has demonstrated that the chemical nature of the soil influences the seed of plants grown upon it, and this influence may be felt for many generations. In this way some of the widely divergent results of experiments may be explained.

Due weight must be given to such preliminary considerations, since we cannot be too careful in determining all the conditions likely to affect the results of agricultural experiments. If we wish to give true scientific exactness to the results, it is necessary to avoid the sources of error of every sort which are so numerous in biological researches.

Liebig was the first to formulate clearly the rôle of water. He stated the function to be twofold. It is a food material and also an assistant to the growth of plants.† The protoplasm of the cell, as well as the cell walls, contains a certain amount of water. In other words, water is an integral part of the cell in certain definite proportions. These proportions must be maintained or the plant suffers.

As water is furnished the plant by the soil, we shall discuss consecutively the two following points: Water of the soil and water of the plant, adding finally some suggestions relative to irrigation.

Water in the Soil.

Water acts in three different ways. It exercises a physical action and is at the same time a chemical and a biological agent, the nature of its action varying with the quantity present.

The soil receives water by precipitation and by absorption. It looses it by evaporation and drainage. The difference between the loss and gain constitutes the reserve for the use of plants. Many methods have been proposed for the estimation of the extent of this reserve, among others by Maurice de Genève (1797), Gasparin (1822),‡ and Pagnoul (1880).§ The method of the latter consists of direct weighing or measuring in the case of small plants. A method proposed by Director Risler,‖ of the Agronomic Institute of Paris, consists of measuring the flow from drains a given surface of land and comparing it with the water which falls upon the same surface, as shown by the rain-gauge. Knowing the amount of drainage and the water content of the soil, the amount of evaporation may be calculated. In order that this method may be reliable it is necessary that no other water than that falling directly upon the surface be measured, also that all the water of filtration be collected by the drains. There is one source of error—poorly drained soils absorb less water than well drained. The water will penetrate only where the condition of the interstices allows it to descend and displace the air filling them. Now, it has been demonstrated that drains increase the number and diameter of interstitial spaces. The drains offer a means of escape for the air which the water displaces and afterwards in a measure suck out the water of the soil by virtue of the vacuum which tends constantly to form at their upper ends.

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* Ann. Sci. Agron., ser. 2, 1 (1896), p. 410; Jour. Agr. Prat., 60 (1896), Nos. 30, p. 113; 31, p. 151.

† *See* also Recherches sur le rôle physiologique de l'eau dans la végétation, Ann. sci. nat. Bot., 1895; Modes d'action de l'eau du sol sur la végétation, Rev. gén. Bot 7 (1895), pp. 71-138.

‡ Gasparin, Cours d'Agriculture, vol. 1.

§ Pagnoul, Ann. Agron., vol. 7 (1881), p. 20; Bul. Météorologique du Pas de Calais, 1880.

‖ Risler, Évaporation du sol et les plantes; Archiv. sci. Bibliothèque universelle, 1879.

Experiments were made by Risler on soil cultivated in wheat, clover, alfalfa, and potatoes. The gauging of the drain which collected all the water was made daily at noon. The number of seconds required to fill a vessel of 4 or 5 litres was determined, and it was assumed that the amount of water collected per second remained constant during the preceding twenty-four hours. This is only exact when the drains collect a diminishing amount of water for a number of days. Whenever there are heavy rains, a number of measurements should be made daily. Risler's tables show that the average evaporation amounted to 70 per cent. in 1867 and 1868. Maurice de Genève found it to be 61 per cent. and Gasparin 88 per cent. These figures are comparable, and show that evaporation amounts to about 70 per cent. of the rainfall. These experiments should be carefully repeated with different crops upon soils of different chemical constitution, with differing inclination and exposure, as well as upon bare soil. The effect of heavy rains and long-continued gentle rainfall should also be compared. It is probable that very different results might be obtained which might have an important bearing on determining the quantity of water to be subsequently distributed by irrigation. Just here, at the outset, there is a serious lack of precise data.

Experiments of this character are worthy of especial consideration by agricultural experiment stations able to conduct them on an extensive and varied scale. The results will be of still greater value if advantage is taken of recent investigations relative to the influence of fertilisers upon the movement of soil water. Numerous investigators, especially Lawes, Gilbert, and Warington,* Frankland, Berthelot,† and Dehérain,‡ have undertaken to determine from examinations of the drainage water the time required to render soluble the chemical principles in fertilisers, the optimum economical quantity of fertilisers to be used, the loss of nitrates in the soil, &c. There still remains much to be learned of the chemical composition of the soil solution. The suggestive researches of Schlössing§ made in the laboratory should be repeated upon soils in place. The influence of the subsoil upon the moisture of the soil should be considered. The investigations of Pagnoul‖ are of interest in this connection to both agriculturists and botanists, since they deal with the effect of different soils upon the spontaneous geographical distribution of plants. Here is found a key to the preferences of certain plants for particular soils. The ideas advanced concerning this question have been far from satisfactory, and it is suggested that the analysis of the drainage water will materially aid in its solution.

In general the amount of water retained by a soil depends upon its physical texture and chemical composition. Near the surface there is ordinarily found from 25 to 35 per cent. of water in soils in place, although the coefficients determined in the laboratory by the method of Schübler give about 50 per cent. These numbers are given in terms of weight, but, from a biological standpoint, the amount in terms of saturation is preferable.

Concerning the capacity of soil for water, absorption, evaporation, and hygroscopicity the conclusions of Wollny¶ are as follows: (1) A compact soil loses more water by evaporation than a loose one, because the capillary spaces are smaller in diameter and more easily conduct to the surface the

* Warington, Jour. Roy. Agl. Soc., 17 (1881), p. 241.
† Compt. Rend., 105 (1887), p. 690.
‡ Dehérain, Ann. Agron., 16 (1890), p. 337; 17 (1891), p. 49.
§ Compt. Rend., 63 (1866), p. 1007; 70 (1870), p. 98.
‖ Ann. Agron., 7 (1881), p. 21.
¶ Forsch. geb. agr. Phys., vol. 5, p. 1.

water in the deeper layers. On this account the surface of a compact soil remains moist longer than a loose one. (2) A compact soil has a greater capacity for water than a loose one, although it is less permeable; the capillary spaces are smaller, the number of water pores are increased, and the penetration of water into the subsoil is hindered. (3) A compact soil offers more water for the plant than a loose one. When it is desired to increase the capacity of a soil for water it must be made more compact.*

The susceptibility of soil to drought is represented by the proportion between the water lost by evaporation and the maximum weight of water it is able to hold. Schlössing† has pointed out the important facts that the size of the soil particles and the degree of humidity exert an influence on the amount of water transported toward the surface. The fineness of the superficial layer‡ also modifies evaporation.

It is apparent that the greater the coefficient of evaporation the less the water capacity of the soil. The capacity for water varies directly as the hygroscopicity. The hygroscopic capacity and the tension of the water vapour varies with the size of the soil particles, being greatest where the soil particles are largest. The following table§ shows the coefficients of absorption, hygroscopicity, and evaporation for various types of soil:—

Coefficients of Absorption, Hygroscopicity, and Evaporation in Soils.

Absorptive capacity—	
Sand	25·0
Clay	40·0
Lime	70·0
Garden soil	89·0
Humus	190·0
Coefficients of hygroscopicity—	
Calcareous sand	1·5
Garden soil	26·0
Clay	17·5
Humus	60·0
Coefficients of evaporation—	
Sand	90·0
Fine garden soil	80·0
Lime	65·0
Clay	35·0
Humus	20·0

To sum up, water is a physical agent which modifies the texture of the soil and influences its aeration, density, cohesion, &c. Water also acts chemically upon the constituents of the soil. In aerating the soil it at the same time introduces ammonia and carbon dioxide, two essentials to fertility, which facilitate the solution of the organic and mineral materials necessary to the plant. The organic materials are rapidly destroyed by the oxygen of the air and the nitrogenous matter is transformed into nitrates, which are partly absorbed by the plant. The mineral constituents undergo modifications no less important. Phosphate of lime is dissolved and the silicates are decomposed by the water charged with carbon dioxide.

It is possible to conduct interesting experiments on this action of water by analysing at different times the solutions which exist in irrigated soil. By systematically repeating these analyses through a series of years it will without doubt be found that irrigation water exerts a steadily diminishing power.

* Edmond Gain, Précis de Chimie Agricole, p. 57.
† Enclycl. Chimique de Frémy—Chimie Agricole.
‡ Chabaneix, Influence de l'ameublissement superficial sur l'évaporation.
§ Edmond Gain, Rev. gén. Bot., 7 (1895), p. 123.

Water is not only a solvent which sets free certain oxides, alkalies, phosphoric acid, and silica, but is a vehicle for the fertilizing elements intended for the roots of plants. Water, therefore, is essential to the utilization of fertilizers. A soil responds very differently to chemical fertilizers under different conditions. The fertility will be considerably increased if there be enough water present to act as a vehicle of the fertilizing substances, while there will be little improvement if the soil is subjected to an extreme drought. Moreover, for certain fertilizers too abundant irrigation is injurious in that the fertilizers are washed into the subsoil. The natural fertility of the soil may also be exhausted by irrigation.

There is need of experiments to show the fertilizers best adapted to dry soils and to moist or irrigated soils.

The experiments of Laws and Gilbert, reported by Dehérain,* illustrate this point. An average of 1·63 metres of water falls at Rothamsted during April, May, and June,† but in 1870 the rainfall for that time was only 76 cm. The harvest of hay was very light on the soils without fertilizers, and also on those which received phosphates and salts of ammonia. There was a smaller deficit on the plats that had received nitrate of soda, as the following table shows:—

EFFECT OF FERTILIZERS ON YIELDS IN DRY AND NORMAL SEASONS.

Fertilizer used.	Yield of hay per hectare.		Deficit.
	1870 (dry year).	Average, 14 years.	
	Kg.	Kg.	Kg.
No fertilizer...	725	2,771	2,046
Mineral fertilizer, no nitrate	3,625	6,527	2,902
Mineral fertilizer and nitrate of soda	7,000	7,250	250

From this it appears that the deficit was almost nothing for the soils receiving nitrate of soda. Under its influence the plants are enabled to send down roots to take some of the water from the subsoil, which is usually moist even in years of extreme drought. France experienced in 1892 and 1893 two seasons of prolonged drought, and all experiments showed that the subsoil always retained considerable water at a depth which was readily accessible to deep-rooted plants, such as wheat.‡

At Rothamsted, in 1870, on the meadows which we have just mentioned, the following data relating to moisture in unfertilized soil were obtained:— At depth of 22 cm., 10·8 per cent.; 44 cm., 13·3 per cent.; 66 cm., 19·2 per cent.; 88 cm., 22·7 per cent.; 110 cm., 24·2 per cent.

This indicates that, in the case of drought, plants will not perish if they are able to develop roots which descend to a sufficient depth. They are not likely to suffer even on a plot without fertilizers if their roots descend to a depth of 66 cm. In soils rich in nitrates, plants have roots 1·3 metres long, and through these they take up large quantities of water from the subsoil, which may contain 25 per cent. moisture at this depth. For this reason, as well as because they are washed out of the soil in a wet season, nitrates are most effective during rather dry seasons.

* Chimie Agricole, p. 665.
† Lawes and Gilbert, Ann. Agron., 1 (1875), pp. 251, 551.
‡ Compt. Rend., 1892 and 1893, May to September.

Warington* has shown the comparative value of ammoniacal nitrogen and nitric nitrogen on dry soils, moist soils, light sandy soils, and marl soils. A dry soil is influenced to a somewhat greater degree by the nitrates than by ammonia salts, while the converse applies to moist soils. Warington's results were as follows:—

ACTION OF NITRATE OF SODA AND AMMONIA SALTS IN DRY AND WET SEASONS.

Fertiliser used.	Harvest of wheat at Woburn.	
	Dry season.	Wet season.
	Hectolitres.	Hectolitres.
Nitrate of soda	23·45	31·57
Ammonia salts	28·86	23·56

It is unnecessary to multiply researches on this point. It is evident that as regards fertilizers there is an opportunity for selection with reference to special conditions which will greatly increase the profit from their use.

The results of fertilizer experiments must not be accepted as infallible. Duclaux† has said that the "meteorology of a region influences the vegetation more than the geology," and we believe that under different climatic influences fertilizers will give different results.

The life of a plant is in effect the resultant of a number of physical conditions acting in conjunction. For example, the action of water will not be the same during a hot and a cold season nor in a moderately cold temperature and a tropical region. The exact knowledge of the influence of water on the phenomena of vegetation, therefore, requires a comparative study of this influence as affected by such factors as temperature, light, fertility of soil, &c.

The fertilizing substances are partially absorbed and retained by the soil and partially dissolved. It is known that drainage water carries off only a small portion of potash, the quantity thus removed being least in well-manured soil. The potash is retained not only by the humus but also by the clay colloids. With an excess of water in the soil the solvent action is largely increased, as shown by the experiments of Gasparin and Berthelot and André. While the soil, therefore, may contain large quantities of soluble potash it is retained with such energy that enormous quantities of water are necessary to dissolve it. The solubility of the potash is greatly increased if some sulphate such as gypsum is added to the soil.

Way‡ has shown that the quantity or ammonia absorbed by a soil is nearly constant when the solutions present have the same concentration, but that the force with which the soil absorbs alkalies varies with the concentration of the solutions. Brustlein§ has shown that soils are not able to remove alkali completely from its solution in water. These solutions circulate to a considerable extent in the soils without undergoing decomposition. This explains how water brings to the plant the chemicals needed in very great dilution. Potash and ammonia are easily retained as carbonates by the soil, but less readily in the form of sulphates.

When a solution of acid phosphate of lime comes in contact with sand, a portion of the phosphate is rapidly absorbed; but absorption is not complete

* Ann. Agron., 15 (1889), p. 213.
† Relation entre la météorologie et la géographie, Ann. Geog., 1894.
‡ Jour. Roy. Soc. Agr. England, 1850, p. 313.
§ Ann. Chim. et Phys., ser. 3, vol. 56, p. 497.

for at least twenty-five days. Still it is believed that there is little serious loss of phosphates by drainage following a heavy rain even in sandy soils, while with lime and clay soils the absorption is naturally more rapid and complete.

The influence of the water of the soil upon the micro-organisms which play a part in the fertility of the soil remains to be mentioned. The experiments of Berthelot* show that the nitrogen of the air is fixed through bacteria in non-sterilised soil; and Hellriegel and Wilfarth, Bréal, Schlössing, and Laurent have shown that the bacteroids in the root tubercles of leguminous plants are able to fix free nitrogen. It is known that the phenomena of nitrification takes place in three steps—formation of ammonia, nitrites, and nitrates†—under the influence of bacteria, yeasts, algæ, and the ferments of Winogradsky. *Bacillus mycoides* is aerobic, and able to produce ammonia in the presence of organic nitrogen, but it becomes a denitrifier and anaerobic when there exists in the soil rapidly reducible substances, such as nitrates.‡

These investigations show that the lower organisms play an important rôle in the fertility of the soil. Water in varying quantity has an influence on the biology of all these organisms. Schlössing and Müntz§ have shown that nitrification requires a certain amount of moisture, and the writer's|| investigations have shown that the vitality of *Rhizobium leguminosarum* is influenced by the water content of the soil. For each soil there is an opitum humidity. Too great dryness checks or entirely prevents the formation of tubercles. Excessive moisture produces an analogous effect, though less marked. The writer has shown that the formation of the tubercles begins soon after the development of the plant, and it is therefore of the highest importance to furnish the young leguminous plant with sufficient water.

As regards the variations in ammonia formation with varying proportions of water, it would appear *a priori* that the results should be analogous to those cited in the case of nitrates.

We think the time has arrived to study with greater care the absolute value of the different optima which are recognised in biology. It is well known that there are optima of temperature, of light, of plant food, and of humidity with which to realise the best possible growth of the plant, but only in rare instances have the values of these optima been definitely fixed. It has been considered sufficient if we knew the optimum temperature for germination of our cultivated plants.

Water in the Plant.

The water of the soil penetrates the plant, being drawn in through osmosis and the aspiration resulting from the transpiration of the leaves. Transpiration assures an exit for the greater part of the water absorbed. The amount of water in the interior of the plant therefore depends on the relative intensity of absorption and transpiration. If the water taken in by the plant diminishes, that given off will also diminish, but more slowly and in less amount. There is then produced a kind of dehydration, which, through the organic balance, tends to increase the osmotic entrance of water for the re-establishment of the equilibrium of concentration of the internal solutions. If there should

* Compt. Rend., 101 (1885), p. 775; 110 (1890), p. 558. Ann. Chim. et Phys., ser. 6, vol. 11, p. 375; vol. 16, p. 490.

† Edmond Gain, Précis de Chimie Agricole, p. 74.

‡ E. Marchal, Production de l'ammonia dans le sol, 1894 (E. S. R., 5, p. 614).

§ Schlossing, Encycl. Chimique de Frémy—Chimie générale (nutrition de végétaux).

|| Rev. gen. Bot., 7 (1895), p. 123.

happen to be at the time a lack of water in the soil, the normal hydration of the tissues is not sustained, and we say that the plant suffers from drought. On the other hand, transpiration being excessive and absorption limited the equilibrium of the sap current is disturbed, resulting in a temporary drying up, which becomes permanent if the cause persists for a long time. The plant, on the other hand, suffers from excess of moisture, because there is a lack of aeration of the underground system. Certain plants are specially adapted morphologically to resist drought and to maintain a constant proportion of internal moisture. This adaptation consists in the provision of morphological mechanisms, which are designed to prevent too great variation in transpiration, as is admirably shown in desert plants, which, as a rule, contain a normal amount of water and are not dried out as they appear to be. The means employed by the plant to control transpiration are well known, but very variable. The leaves are greatly reduced in size, or thickened as in fleshy plants, in order to reduce the transpiring surface or to increase the reserve water; the stems are gradually lignified, the stomata are placed in protective depressions, the greatly developed trichomes form a protective screen, the epidermis has a thickened cuticle, the reserve water is stored up in special reserve tissues or in the root, which is proportionately developed. J. Vesque* has discussed this special adaptation of the plants to different water conditions, showing that plants change their structure in order to adapt themselves to diminished water supply.

Another factor which is no less important is the capacity of soil for water. For the same proportion of water soils of different natures, as already explained, possess different coefficients of hygroscopicity, permeability, and liability to desiccation.

The early experiments of Sachs† show that tobacco suffers when the water content of clay soil is 8 per cent. and of sand 1·5 per cent. The writer has repeated these experiments with many plants in order to settle the following questions: (1) Is the power of resistance to drought of a given plant the same in different soils? This question must be answered in the affirmative. (2) Is the water content of the soil at the time when plants wilt the same for all stages of plant growth? No; it fluctuates in such a way as to produce a curve. These two questions are interesting to agriculture from the point of view of rational irrigation.

The following plants become dry and suffer from drought with the given water contents of soil:—

WATER CONTENTS OF SOILS AT WHICH DIFFERENT PLANTS BEGIN TO WILT.

Soil.	Phaseolus vulgaris.	Erigeron canadensis.	Lupinus albus.
	Per cent.	Per cent.	Per cent.
Peaty	10·60	9·40	11·10
Clay	9·58	7·78	11·35
Humus	5 92	6·83	6·95
Lime	2·90	4·25	5·23
Garden	1·88	2·40	2·91
Sand	0·35	0·48	0·75

* Anatomie des tissus appliquée a la classification des plantes, Nouv. Archiv. du Museum, n. ser. 4 and 5. L'espèce au point de vu de l'anatomie comparée, Ann. sci. nat. Bot., ser. 6, Vol. XIII. Numerous papers on the rôle of water, Ann. sci. nat. Bot.

† J. Sachs, Physiology of Plants. Translated by H. Marshall Ward, 1887, p. 258.

The writer would urge agricultural experiment stations to make experiments analogous to these with different cultivated plants. The following plan is suggested: Establish a series of experiments on typical soils and on the mixed soils which are found at the stations. In order to eliminate the influence of the subsoil, use pots about 80 cm. in diameter and about 80 cm. in depth. Large barrels cut in two serve the purpose well. Bore five or six holes of about 4 cm. in diameter in the bottoms for aeration, and place the tubs in holes in the ground upon supports about 20 cm. in height, so that the edge of the tubs will be about on a level with the surrounding soil. For each plant experimented with two series of ten pots each will be required. In the first pot place clay soil, in the second lime, in the third humus, in the fourth clay, in the fifth peat soil, in the sixth garden soil, and in the seventh, eighth, ninth, and tenth mixed soils. The two series should give the same results. If they do not a possible error is indicated. Many experiments may be made during the year with different varieties of the principal cereals. If it is desired to study five varieties of wheat, 100 pots will be required. The plants should be studied from the two points of view stated above. It is necessary to note the point at which wilting occurs during each stage of growth, taking samples of soil and determining moisture for this purpose. The exact state of drought which causes positive injury to the plant should also be determined.

By watering plants wilted to different degrees, and at successive periods of vegetation, it may be possible to establish morphological characteristics of the highest interest. It may thus be shown how a plant is affected under the influence of alternate drought and humidity, and how plants behave upon different soils, as well as what it the result of permanent and excessive drought or humidity, and of judiciously combining drought and humidity. The author has conducted general experiments along this line, and it may be of interest to discuss the conclusions from this work in its agricultural bearings.

In order to apply these conclusions to agriculture it is necessary to know what cultivated plant is to be especially studied, *i.e.*, whether a cereal, a forage-plant, or a tuber-bearing plant. It is possible to deduce a correct rule of irrigation based upon a curve showing the water requirements of the plant under consideration for each period of its growth, but there is a considerable difference between the necessary water which a clay soil and a sandy soil must possess to prevent plants from drying out and dying from drought. In the author's experiments it was found that clay soil requires more than 11 per cent. of water to prevent lupins from perishing, while 1 per cent. suffices in a sandy soil. The hygroscopicity of sand being practically nothing, the water which is found in a sandy soil is all available for the plant. In other words, in a clay soil there is from 10 to 11 per cent. of moisture which is not available to lupins, since about 10 per cent. is retained by the hydroscopic action of the soil. For different plants this amount varies, being 11 per cent. for lupins, 7·7 per cent. for Erigeron, and 9·6 per cent. for beans. These variations are as great for different soils as for different plants.

If K represents the capacity of the soil for water, a the hygroscopic water of the soil, the maximum amount of water available to plants per 100 gm. of soil will be $Q = K - a$. It is this value of Q which is of great importance from a biological standpoint in experiments on the rôle of water in the physiology of a given species of plant. It will be found that a varies from 0 to 15 and perhaps more. It is apparent then that it is important to know the value of this factor for different species of plants, since it determines so

largely the value of Q. In general the soil should not be saturated, but ought to contain about $\frac{1}{n}$ of K, and in rational irrigation the effort should be to realise the optimum value of $\frac{1}{n}$ which in this case is $Q + a = \frac{K}{n}$. As already observed, the proportion of water in the soil which is not available to the plant should be determined.

In a locality which receives a certain average rainfall and is subject to a period of drought, the same species of plant will show different conditions of growth according to the nature of the soil. In humid countries, such as Ireland, those soils which contain most silica are regarded as best for wheat; and in dry countries, such as Italy, those which contain most alumina. The sandy soil does not draw up or retain moisture, which is not needed in the north, while the alumina conserves the somewhat deficient moisture of the southern region.

There is an evident relation between the quantity of water which circulates in a plant and the dry matter elaborated. This relation is as yet little understood. Dehérain, repeating the experiments of Haberlandt, has found that 1 kg. of dry substance is elaborated by a plant on an unmanured soil for every 680 kgs. of water transpired by the plant, and for every 220 kgs. of water upon the same soil when manured. Wollny has also studied this question on manured and unmanured soils. Hellriegel has found that there exists an optimum for the production of dry matter in plants, and that the product varies according to the amount of moisture. Representing by 100 the quantity of water necessary for a complete saturation of the soil, Hellriegel found that the production of dry matter in barley varied with different water contents of the soil as indicated in the following table :—

DRY MATTER IN BARLEY ON SOIL WITH DIFFERENT WATER CONTENTS.

Moisture in the Soil.	Yield in dry material.	
	Grain.	Straw.
per cent.		
80	8·77	9·47
60	9·96	11·00
40	10·51	9·64
30	9·73	8·70
20	7·75	5·50
10	·72	1·80
5	....	·12

The table shows that the optimum humidity is not the same for grain and straw. These results show that in the case of two soils, the one containing 30 per cent. and the other 60 per cent. of water, more grain would be grown on the first plot than on the second.

If experiment stations would conduct upon a large number of plants the experiments described above, results of great practical value would be secured. For example, with two dry soils containing from 10 to 15 per cent. of water and capable of irrigation, what should be the method followed? Will it be necessary to continue a humidity of 60 per cent. during the entire period of growth? The author's experiments show that there are many possible ways in which to secure a maximum yield. To give water to a plant at the proper time after a slight drought gives better results than maintaining a permanent

optimum humidity. Periods of relative humidity and drought are in general very advantageous to plants, and the number of land plants which require a permanent humidity for maximum production is very small. It may be asserted as established that (1) for a given plant an interruption, however short, during a dry period proves very beneficial, and (2) some plants which require a certain amount of humidity during one period are able to resist drought to a considerable degree during the following periods of their growth. The results of numerous horticultural experiments prove this statement.

The different organs of the same plant vary in their requirements. The optimum humidity for the individual, therefore, is not the same for all stages of growth, nor for each organ of the plant. Not only has each part of the plant certain characteristics peculiar to itself, but at a given time different organs of the same plant are in different stages of development.

It is thus seen how extensive is the field of investigation in this line. There is need of investigation of such questions as the following: With a given species of plant in a given soil what amount of moisture must be supplied during each stage of growth in order to obtain the best result for each plant organ? For example, for sugar beets in a clay-lime soil how much water must be given during the three months of growth in order to secure the maximum production of foliage or in order to obtain the maximum amount of sugar?

The general formula which is given above may serve to suggest a large number of practical experiments. To determine a question of this kind it is simply necessary to make comparative cultures in the open soil and in pots. The effect of different moisture conditions is noted—resorting to chemical analysis if it is a question of determining the constituents of a plant, or simply weighing the products if only to establish the gross returns. The following is an important question which may thus be studied: What is the proportion of crude and digestible fibre obtained by different methods of irrigation applied to plants in natural meadows and to the same plants in artificial meadows? This question is of vital importance to the rational feeding of animals, since it permits a comparative valuation of forage-plants grown under known conditions.

The proportion of the internal water influences not only the dry weight of the final product, but also modifies completely the chemical nature of certain of the elaborated materials. This influence should be the subject of further study. If a plant is grown under different moisture conditions, it will be found that the relative quantity of certain intermediate products will also differ. The production of glucosids, tannins, essential oils, fats, alkaloids, and colouring material is particularly influenced by drought and moisture.* The production of sugar and organic acids in the fruit and in the sap also varies under the same influence. The author's analyses have shown that the production of chlorophyll is different upon dry and wet soils, a fact which explains many other variations in the elaborated materials of the plants. Illustrations of the above facts are found in the experiments of Lawes and Gilbert, Dehérain, and Lechartier on the comparative chemical composition of cereals and potatoes during dry and wet years. According to Dehérain the spikes of oats contained 12·37 per cent. of nitrogen in 1879, a dry year, and only 6·50 per cent. in 1878, a very wet year, the conditions being otherwise the same.

* E. Gain, Sur la matière colorante des organes souterrains, Bul. Soc. Bot., France, 40 (1893), p. 95.

In comparative experiments with tobacco, Mayer* studied the influence of water upon the production of nicotin, and found that the more moist the soil the less the nicotin. The percentage of nicotin in dry matter of tobacco grown on three soils containing different amounts of water were as follows: In the first, 2·7 to 3·1 per cent.; in the second, 1·45 to 1·75; and in the third, 1·05 to 1·02. The total dry matter varied with the nicotin content, but not proportionately. This indicates that without injuriously affecting the growth of the plant the formation of nicotin may be greatly reduced. In the tubers of artichokes the content of potash and phosphoric acid is greater in moist than in dry years.† In a dry year the leaves are rich in phosphoric acid, the amount in the tubers being proportionately small.

For each period of growth of an organ of a plant, therefore, there is a certain definite portion of internal water necessary for normal and healthy condition, the same being true for each stage of development of the entire plant. Water produces in the organ or plant under consideration a state of turgescence and normal hydration. This turgescence is produced in each vegetative stage by variable proportions of water, as has been shown by the author's investigations as well as those of Gelésnoff,‡ Sorauer,§ and Jumelle.‖ The study of the variation in the water content of plants is necessary, therefore, in order to determine how water may be most economically and advantageously distributed by means of irrigation. From the results of his experiments the author has been able to draw curves for the development, respectively, of the hypocotyle, cotyledons, root, stem, and leaves. He has also studied the development in general of the entire plant. These curves are based on the proportion between dry weight and total weight of each organ at different periods of growth, noting also the duration of the different stages of growth.

The root usually presents a weakened condition at the flowering period, at which time there is a transfer of substances towards the flowers. This weakening remains for a considerable time and is especially marked if the plant is upon a very dry soil. If, after flowering, the root is furnished with an increased supply of moisture, the period of growth is stimulated and prolonged. When the root prematurely dries, the vitality of the entire plant is soon checked.

Roots play a rôle in regulating the water content of the aërial part. If the quantity of dry weight tends to become too great, the root furnishes the water necessary to establish equilibrium in the aërial portions of the plant. It is interesting to note that plants well adapted to withstand drought are nevertheless likely to profit by a supply of moisture. This is true of buck-wheat.

If the proportion of the water of the root be compared with that of the stem it will be seen that (1) humidity favours a general development of the plant in weight, and (2) the influence is greatest on the aërial part of the plant. For two stems of the same weight there will be the greatest development of the root in a dry soil.

The most active growth in a plant precedes slightly the flowering period. A more or less abundant supply of moisture favours this growth to some extent, but in any case at the time of flowering the water content of the plant is approximately the same for a given species whatever the water supply. The flowering period is a time of unusual transpiration, which produces a

* Landw. Vers. Stat., 38, p. 453.
† Ann. Agron., Feb., 1892.
‡ Quantité et répartition de l'eau dans les organes des plantes, 1876.
§ Influence de l'abondance ou du manque d'eau, Bot. Ztg., 1878, p. 14.
‖ Sur le développement des plantes annuelles, Rev. gén. Bot., 1889.

diminution in the proportion of internal water. This is a very critical period, in which desiccation may go so far as to arrest assimilation and completely check the increase in weight. If the plant is furnished with sufficient water to carry it over this period, not only will its vitality be continued during fruit bearing, but ordinarily it will push out new branches and new leaves, the action of which may be prolonged a considerable time after the period of flowering. The beginning of flowering is, therefore, a critical period which decides the weight of the final product, the fresh and dry weight doubling in a very short time. Internal desiccation, however slight, is an obstacle to this growth and influences the maximum product of the plant.

Considering now the phenomena of growth as distinguished from increase in weight, we see (1) that although a saturated soil produces a rapid swelling of seed, germination is generally checked, principally on account of a lack of aëration in the soil; (2) that a soil which is about half saturated greatly favours germination; and (3) that a dry soil in which there is sufficient water to cause the seed to swell, but in which that removed by evaporation is not restored, gives a germination almost as rapid as a semi-saturated soil, but the subsequent growth is considerably checked through lack of water. When, therefore, the optimum conditions are departed from, growth is generally checked, but to varying degrees. Plants which resist humidity well, or which are somewhat indifferent, have a high optimum. Those plants which suffer from humidity have two possible obstacles to growth, since their healthy condition is affected by excessive moisture as well as by excessive drought. For such plants as cucurbits, castor beans, and maize, the optimum of humidity is not very high, and their growth is checked to a considerable degree if the optimum is exceeded. Attention is here directed to a previous paper by the writer,* in which the capacity and duration of growth of different organs under the influence of varying humidity is discussed. It is there shown that flowering is retarded by dry soil or humid air and hastened by dry air and humid soil.

As regards increase in weight, the author's experiments show also that humidity, and especially excessive irrigation, is very harmful to plants intended for seed production. On wet soils the seeds are somewhat more numerous, but smaller, and subject to rapid degeneration. Dryness of the soil, in compelling the individual to grow slowly and by decreasing considerably the number of its descendants, strengthens the species and protects it against external influences causing variation.

The same conclusions were reached relative to tubers. Excessive moisture weakens the race while apparently favouring the individual by increasing its growth. The tubers are heavier, but are less perfect than those which are produced under drier conditions.

Practical Applications.

According to King,† after a rain, soil to a depth of a metre and a half, contains about 6,000 tons of water per hectare, the greater part of which is carried off by evaporation. Cultivation is very efficacious in preserving this water. Professor King determined on April 28 the quantity of water contained in two contiguous soils, afterwards ploughing one of them. Seven days later the water content was examined to a depth of 1·2 metres. The ploughed soil had lost from the upper 30 cm. 11·5 tons per hectare, and there

* Recherches sur le rôle physiologique de l'eau dans la végétation, Ann. sci. nat. Bot., ser. 7, 20 (1895); E.S.R., 7, p. 366.

† Wisconsin Sta. Rpts. 1891, p. 100; 1893, p. 184 (E.S.R., 4, p. 122; 7, p. 565).

was a gain of the same quantity of water for the succeeding 90 cm. The unploughed soil, on the contrary, to a depth of 1·2 metres, had lost 495 tons of water. Spring ploughing, therefore, conserves the humidity necessary for plants, but although this ploughing is very efficient, harrowing and scraping poorly done is not. Harrowing which simply scratches or furrows the surface without covering it completely with loose soil increases evaporation rather than reduces it. On the contrary, a layer of dry soil 2 cm. deep greatly reduces evaporation.

When a given soil produces vigorous plants whose transpiration is very active, and young plants whose organs are less developed, the roots of the first will take up for themselves the humidity of the soil with greater force than those of the second. If the soil does not contain sufficient water for both, the weaker will suffer. This is the case with clover seeded with wheat in the autumn, which suffers in a dry spring, while clover seeded alone makes good growth. Farmers continue to sow their forage seed with cereals under the mistaken idea that the cereals are beneficial as a shade. If they would seed their forage plants alone, they would not only secure a greater yield but in dry countries they would stand a better chance of producing a crop.

This also explains certain facts relative to the irregular production of seed of the same kind of plants. The stronger plants take from the others the moisture and the fertilizers held in solution, and are thus enabled to produce more perfect seed. This is also the case with trees in a field, which are well known to injure plants cultivated about them. Weeds injure cultivated plants in the same way. In view of these facts it would be interesting to investigate from a practical standpoint the effect on the total product of sowing crops together and cultivating one crop between the rows of another. An attempt should be made to determine by experiment the proportional reduction in the yield of one group of plants growing in the same soil with another, as, for example, legumes cultivated with cereals or between rows of potatoes.

Opinions are very diverse as to the cause of the efficiency of water employed in irrigation.* Some claim that the fertilizing action is due entirely to materials held in solution, and that water for irrigation should be turbid and impure, while others maintain that clear water produces the best results. It is known that the quantity of carbonic acid contained in water and its temperature modify the fertilizing action to a very great degree on different soils.

Prof. Ronna† has shown that upon clay soils abundant rains which thoroughly saturate and flood the soil may advantageously take the place of fertilizers. In dry seasons fertilizers remain without effect in the soil, and in most seasons no fertilizer is able to supply the fertilizing effect of rain. Water dissolves the elements of the soil which are necessary to the growth of plants. In well-manured, high, sandy soils the abundant spring rains wash out the soluble materials, such as nitrate of soda and guano. Pure water may be beneficial on some soils but injurious to others. Water charged with fertilizing elements is a valuable agent in fertility, but it must not be forgotten that on well-manured soil it may carry off more than it brings to the soil. This is the case when sewage waters are applied in excessive amounts. Voelcker has called attention to the presence of nitric acid in many waters suitable for irrigation. He insists on the necessity of studying the natural causes of loss through filtration of the fertilizing materials. In

* On irrigation: A lecture by Prof. Voelcker (Jour. Roy. Agl. Soc. of England, 1867, p. 464).

† A. Ronna, Chimie appliquée à l'agriculture.

intensive cultivation the art consists in preserving the fertilizing materials as much as possible at the surface, where they provide for the needs of the plant at the beginning of its growth. Voelcker concludes that in order that irrigation with sewage water may be profitable on sandy meadows it will be necessary to employ about 20,000 cubic metres of water per hectare in 4 or 5 separate applications. Plants which grow rapidly make use of the fertilizers about them; but, on the other hand, cereals and truck crops are not able to receive large quantities of water throughout the entire year. Green plants produced by sewage water are not as nutritious as those grown on meadows irrigated with pure water.*

It is not a question of storing up fertilizing matter in the soil, but of rapidly disseminating it through the soil by means of the water. Experiments by Voelcker on the absorbent power of different soils on dilute solutions of ammonia, phosphates, and potash confirm this conclusion.

Ronna showed that meadows in England had been irrigated with water containing a large amount of lime with admirable results. It is only necessary to avoid such waters as come from peaty or marshy soils, since ordinarily they are charged with sulphate of iron.

It is not necessary for us, in a general dissertation, to go into details as to the quantity of water required for irrigating under each method of culture. The quantities vary according to the meteorological conditions of the regions under consideration. In the south of France about 16,000 cubic metres of water per hectare are required for six months' irrigation. Nevertheless, we are guided somewhat by experience, and give to the agriculturist as a basis the following general curve based upon the results of experiments:—

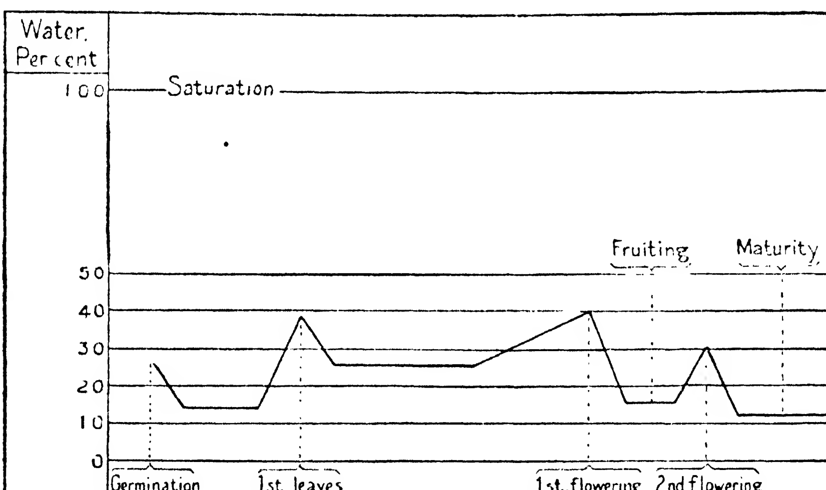


Fig. 1.—Diagram showing water requirements of plants at different stages of growth.

This curve is intended to indicate for plants of ordinary habits of growth the optimum amounts of water in the soil at different stages, the amounts

* Third Report of the Commission for inquiry into the best mode of distributing the sewage of towns, p. 48. London, 1865.

[This matter has been referred to in the *Agricultural Gazette* in discussing the methods adopted by Chinese gardeners.—Ed.]

being stated in percentages of saturation. It will be noted that the curve is characterised by a regular alternation of humidity and relative drought, as already explained.* From the point of view of legislation and co-operative societies for irrigation there is, at least in France, a serious difficulty in the use of this curve. The farmers necessarily have not the same soils to irrigate nor the same crops, and, consequently, there will be a serious complication in distributing the water, the demand for which is periodical and not constant. Nevertheless, to all those who are personally interested in proper irrigation the deductions from our theoretical investigation are commended. The application of these suggestions will certainly result in a much more valuable product.

* The experimental basis upon which the curve rests has been discussed at length in a previous article by the writer, an abstract of which will be found in E. S. R., 7, p. 366.

Fig. 1.

THE CURRANT CLEAR-WING MOTH.
(*Sesia tipuliformis.*)

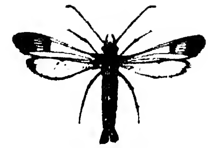


Fig. 2.

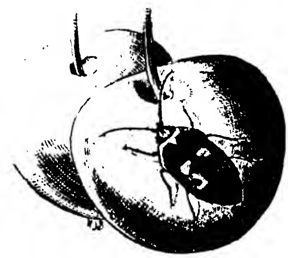
THE VINE-MOTH BUG.
(*Arma sibellanbergi*, Germ.)

Fig. 3.

A GRAPE-DESTROYING BEETLE.
(*Monolepta diversa*, Blackb.)

Fig. 4.

THE CHERRY BUG.
(*Peltophora picta*, Germ.)



THE PEACH MOTH.
(*Conogethes punctiferalis*, Gn.)

Fig. 6.

SHOWING PUPA OF PEACH MOTH IN A PEACH DESTROYED BY THE CATERPILLAR.

Entomological Notes.

BY WALTER W. FROGGATT,
Government Entomologist.

THE CURRANT CLEAR-WING MOTH (*Sesia tipuliformis*).

THOUGH this little hawk moth was introduced into New Zealand some years ago, this is the first record of its occurrence in Australia. Early last October one specimen was obtained from a bundle of red and black currant twigs, pruned from some bushes growing in the Governor's garden at Sutton Forest.

During an official inspection by Mr. J. H. Maiden he noticed that many of the currant bushes were infested with borers, and instructed the gardener to forward some branches to the Agricultural Department for investigation. Unfortunately it was rather late in the season, and most of them had emerged, while many of the branches had been cut off too short and the grubs left behind. However, enough specimens of living larvæ and pupæ were cut out to complete their life history.

This has been a well-known pest to currant growers for many years in England. Miss Ormerod says that the eggs are laid early in the summer in some crack or crevice upon the bark, from whence the little grub gnaws its way into the central pith of the twig, remaining in the pupal state until the following March. The branches examined had the centre tunnelled out, at the end of which was found the caterpillar or pupa; many of the tunnels extended for several feet, and eventually caused the branch to wither and die.

The caterpillar is a dull white creature about half an inch in length, with a dark brownish head rounded and slightly lobed, the legs short and cylindrical, and the segments of the body distinct but narrow.

The pupa measures about 5 lines in length. The basal portion is dark brown, the rest much lighter in colour; the apical edge of each of the abdominal segments upon the dorsal surface fringed with fine spines, and the tip of the abdomen carrying several angular protuberances.

The moth measures 9 lines across the wings and 5½ lines from the head to the tip of the abdomen. The antennæ are thick, the eyes fringed with fine yellow hairs, and the body long and slender, thickly covered and fringed at the tip with a flat hair-like brush of long scales. The wings, as its name implies, are transparent with the nervures, a band at the tips, and a slender one behind, which curves round to the tip, thus enclosing an oval transparent patch on the fore wings, and a fine line of black scales along the hind wings. As we have no native hawk moth like this species with its distinct black colouration and variegated wings, it will be easily recognised when met with among the currant bushes, and it is not known to attack anything else.

The best preventive for the spread of this moth is for all growers to prune off any branches that look sickly, and if they are found to be attacked by borers to be sure to cut them off so that the grubs are not left behind, and burn them. A great many pests are bred from pruned branches and dead trees that should always be destroyed, for as soon as decay sets in, many insects, particularly wood-boring beetles, are attracted, either to feed upon the withering bark or to lay their eggs in the wood.

As we know that the moth emerges early in October, growers can be on the look out for them at that time, and keep them in check. (See Plate, fig. 1.)

AN INSECT ENEMY (*Arma silbellanbergi* Gérmer.) OF THE VINE MOTH (*Agarista glycine*, Lewin).

THE first information I received as to the beneficial habits of this active little plant bug, was from a correspondent some three years ago, who when sending some specimens for indentification informed me that they had cleared his orchard of the larvæ of the fig-leaf beetle (*Galeruca semipullata*, Clark), which threatened at one time to strip every leaf off his fig-trees.

Since then this bug has turned its attention to the caterpillars of the vine moth which within the last few years have increased with such rapidity in our vineyards that they are one of the most serious insect pests our vignerons have to cope with; and this is mainly accounted for by the fact that from some acrid taste or their hairy covering no birds, with the exception of two of our cuckoos, which unfortunately are rather scarce birds, will touch them. I have frequently taken a handful of these caterpillars and thrown them in the fowlyard, but the moment the fowls pecked at them they turned away in disgust, and would have nothing further to do with them.

Mr. Musson writing from the Hawkesbury Agricultural College says, "Could you give me the name of this bug we have noticed in our garden for the last two seasons destroying the vine moth caterpillars."

Mr. J. Sherack of Minto says that a great number of their eggs were noticed upon the leaves of the vines, and that a number were destroyed under the impression that they were the eggs of the moth, until the young bugs were observed emerging from them, and since then the bugs have increased in numbers and usefulness every season.

At least a dozen other correspondents have sent in specimens of this bug with notes on its beneficial habits, and as these have come from all parts of the country it is evident that it is increasing in numbers and activity, and in time to come may prove to be a very important ally of our gardeners. The Vine-bug (*Arma silbellanbergi*) belongs to the order Hemiptera, and the Family *Scutelleridæ*, so many members of which are destructive to fruit, sucking up the juices in the same manner that this one attacks the caterpillars.

It measures half an inch from the tip of the head to the end of the body, and is of a general greyish-brown colour, with the whole of the upper surface thickly interspersed with light yellow spots, which gives it a rather mottled appearance; the margins of the prothorax and the scutellum also light yellow. The snout comes to a sharp point, with the sides of the prothorax running out into angular spines, giving the head and thorax combined a triangular appearance; the sides of each abdominal segment are marked with black, all the under surface and legs yellow, and both the upper and under surface covered with fine impressed punctures, with the exception of the membraneous tips of the wings which fold over each other. The eggs are laid side by side upon the leaves, forming a patch of from a dozen to thirty; these eggs are

round and semi-transparent with a curious cap-like covering on the top with raised points forming a fringe right round; they are very pretty objects when viewed with a lens, and with the curious lid and shining transparent shell cannot be easily mistaken for the moth's eggs. (See Plate, fig. 2.)

The Vine Moth.

In the county of Cumberland the first crop of caterpillars were very numerous and destructive in October and November, not only eating the foliage but also, in many instances, the young grapes. These caterpillars which reached maturity formed their cocoons, and emerged as perfect moths in February, the caterpillars from their eggs forming the second brood which strip the vines after the grapes are gathered.

The full grown caterpillars of the October or Spring brood crawl down the vine and form great numbers of their loose silken cocoons covered with a coating of sand round the stem of the vine just above the surface, or more frequently round the vine stake, often clustered together like the cells of a mud wasp nest; the remainder burying themselves beneath the surface of the soil.

This would be the time for the vignerons to take action, for every chrysalid destroyed would mean the death of a moth, and every pair of moths would mean the destruction of the unlaid eggs.

Several of our correspondents have suggested methods of trapping the moths, and some, under the impression that they are like butterflies always flittering about on the look out for sweet things, have proposed erecting among the vines sugared boards, against which the moths would fly and be destroyed; but the vine moths are not particularly fond of sweets. Their first mission in life is to deposit their eggs, and until this is accomplished they would not be led astray by sugared traps, and after the eggs were laid it would be very little satisfaction to catch them.

The simplest and most effective method of destroying the caterpillar is by spraying the foliage of the vines with Paris Green, in proportion of one pound of Paris Green to 100 gallons of water, or when making small quantities, a quarter of an ounce to two gallons of water; the proportion of Paris Green can be increased if not found effective. The vines should not be sprayed in the hot sunshine but in the early morning or evening, or in cloudy weather, otherwise the foliage may be burnt.

I should strongly advise a good spraying for the summer caterpillars, as from their chrysalids come the moths that lay the eggs, from which come the spring brood that do the damage when the young grapes are forming and the vine needs all her wealth of foliage.

Those persons who hand-pick the caterpillars in a vineyard can never expect to clear their vines, as every time they go over them the smaller caterpillars, upon which the Paris Green acts most rapidly, are left behind, and the expense of spraying with this poison, even several times in the season, is not to be compared with employing labour to hand-pick them. There is not the least doubt that united action on the part of the vine-growers would soon keep this at present very serious pest within bounds.

A Grape-destroying Beetle (*Monolepta diversa*, Blackb.).

In its native state, this small *Chrysomalid* beetle is found upon the flowers of the dwarf angophora, one of our small "apple-tree" gums, the flowers of which are sought after by so many insects in the early summer. A number

of specimens were received from Mr. H. Doherty, of "Harefield," Grenfell, with the information that they were found attacking the young grapes just as they were setting, and causing a great deal of damage.

They were afterwards observed upon the peach trees, gnawing the foliage and forming little brown lumps upon the tips of the leaves.

Upon the examination of some of these lumps forwarded with the beetles, they were found to consist of a gummy capsule covering a slender yellow egg.

This beetle has the typical form of the genus *Monolepta*, which contains a number of well-known plant-eating beetles; this is one of the smaller ones, hardly more than one-twelfth of an inch in length, having the eyes, antennæ, tarsi, and apical half of the wing cases black, the rest orange-yellow. The best plan to get rid of these beetles when the vines cannot be sprayed is to shake them gently on to a sheet spread below; if this were done early in the morning when the insects were sluggish, most of them would fall and could be destroyed.

When upon the foliage of the peach trees, a weak spray of kerosene emulsion would destroy both eggs and beetles. (See Plate, fig. 3.)

The Leaf Case Moth (*Thridopteryx hubnerii*, Westwood).

In the early summer months, one often comes across a eucalyptus bush with its foliage fairly riddled by the young caterpillars of this case moth, which is one of the most plentiful species about Sydney. Each caterpillar is covered with its conical little cap, and moves about in a very comical manner by means of its protruded legs while it gnaws the upper surface of the leaf. Lift up one of these caps and you will find that it is a little silken funnel covered with woody dust and minute particles of the leaves, covering a dark-brown grub, just like many other little caterpillars; but some remote ancestor, probably finding his hairless, smooth, body was a tempting morsel for prehistoric birds or insect enemies, evolved a covering, and his descendants have profited by his example. By some means, however, both flies and wasps manage to lay their eggs upon the caterpillars; fully 90 per cent. never get beyond the chrysalid state, and it is very difficult to obtain good specimens of the males of any of the case moths. The life history of several of our case moths is very well known, but as some of our many readers may not know their habits, the following notes are given. The female insect, which constructs a cocoon exactly like the male, never leaves her case or becomes a perfect winged moth; she reaches a certain size and undergoes an incomplete metamorphosis with her last moult, and is impregnated by the male moth from a hole at the base of the case, from which, in due course, emerge living young, each with a little thread to launch itself on the foliage. When keeping the cocoons, one often finds the box swarming with these little creatures hanging in long black strings from the maternal case. As soon as they find themselves on their food they set to work to cover themselves, and are not particular what the material is. I once kept some upon a sheet of red blotting-paper, and afterwards removed them to a sheet of blue, so they had first a red cap and then a basal ring of blue.

The male chrysalid, on the other hand, changes into a most active, perfectly-developed moth; but before the caterpillar changes, it turns round in its case after it has securely fastened it at the top to a twig, and pupates so that the head is turned down to the tip of the cocoon, from which it can

easily make its exit. This moth is seldom met with, for as soon as he escapes he dashes off in a most reckless manner, hunting about for his mate, and his life is short.

It is in the larval state that these moths do the damage to cultivated plants, and of late years they seem to have developed a taste for a very varied diet.

In December Messrs. Searl and Sons sent me a number of the young cases with the information that they were very destructive to the foliage of chrysanthemums in their gardens at Botany.

Mr. Gorus, of this department, a few weeks later sent a bunch of young grapes and foliage from a vineyard at Seven Hills covered with small cases, the occupants of which were feasting upon both grapes and leaves.

Mr. W. Moseley, of Parramatta, brought me some very pretty cases covered with fragments of oak leaves, and informed me that a large English oak tree growing in his garden was so thickly covered with them that they threatened to completely defoliate it in a very short time, if not destroyed.

When small, and particularly when feeding upon small trees or plants, a good spraying with Paris Green, from about 1 lb. to 100 gallons of water, would soon clear them out; while collecting all the large, full-grown cases and destroying them before the larvæ emerge would save a lot of future work where they are plentiful.

The Elephant Beetle (*Orthorrhinus cylindrirostis*, Fab.).

About the end of last December a number of these beetles were found upon an apple tree in my garden at Croydon, my attention being first called to their presence by noticing that a great deal of the bark upon the young wood was gnawed off in irregular patches, sometimes nearly right round the twig. Upon examining the tree closely for the cause, about a dozen of these long-legged weevils were found clinging so closely to the branch while they were gnawing at the bark that, in spite of their large size, they could be easily overlooked.

For the next fortnight I found one or two nearly every day, and then the supply ran out. As they are strong-flying beetles they probably found their way over from the bush paddocks of Abbotsford or Five Dock.

In their native state they show a marked preference for freshly-fallen timber when the bark is just beginning to wither, and I have often found them upon a freshly-cut rail or log before it has been barked; if there are any about the neighbourhood they seem to find them very quickly. Some specimens kept in a building-case gnawed most of the bark off a branch placed in with them, and upon the 8th of January one was observed to be clasping the twig with the middle and hind legs, with the long forelegs and head hanging downwards moving the tip of the abdomen, which was closely pressed against the bark. When examined next day a small circular pin-hole about half a line in depth was found, at the bottom of which was a single bright yellow rounded egg.

When the trees are small hand-picking would be the simplest method of clearing out these beetles, as once their presence is noted they are easily found; upon large trees a spraying of Paris Green would destroy them.

In Vol. I of the *Agricultural Gazette*, N.S.W., 1890, the late Mr. A. S. Olliff gave an interesting account of this beetle, illustrated with a plate; but in that paper it was their larvæ that were boring into the wood of the orange trees that was noticed, and not the perfect beetles, as in this case.

The Cherry Bug (*Peltophora picta*, Germ.)

About the end of December, Mr. G. E. Griffiths, of Rocky River, sent in several specimens of this handsome shield bug, which he stated was doing a great deal of damage to his cherry crop.

They were swarming over the trees, and attacked the ripe fruit by piercing the skin with their sharp beak and sucking up the juice, causing the cherries to rot and fall.

When alive the general colour is rich metallic green, but dried specimens fade into a bluish duller tint; the sides and front margin of the thorax, with two broad spots on the shoulders, and the under surface red; upon the wing cases are two dull blackish marks on either side; the legs are variegated, the basal half of the thighs and tibiæ red, the rest metallic green, with markings of the latter colours along the edge of the abdominal segments. The back is rounded, the head small, with the thorax coming to a point in front; the thorax and abdomen tapering to a rounded tip. This bug has a wide range over the northern parts of New South Wales and southern Queensland, while further north its place is taken by another species of the same genus which I have seen in thousands feeding upon the wild figs upon the banks of the Burdekin River.

It would be difficult to catch these plant bugs with a spray without spoiling the ripe fruit; the best method to deal with them then would be to shake each bunch over a shallow dish containing kerosene and water, or spread a sheet under the tree and shake the lot down, killing them afterwards. (See Plate, fig. 4.)

The Peach Moth (*Conogethes punctiferalis*, Gn.)

Several chrysalids of this handsome little moth, together with the fruit attacked, were forwarded by Mr. R. Stobo, of Miller's Point, who received them from Mr. Alexander Campbell, Wooroowoolga Station, Casino, N.S.W.

I have never seen the caterpillars, but from the peaches received their method of attack is as follows:—They enter the green unripe peach close to the stalk and feed upon the fleshy part, gradually eating it all out right round the stone; gnaw out a small chamber in the side of the stone, line it with a silken web, and pupate. The chrysalids were received upon the 8th of December, and two moths emerged upon the 18th of the same month.

The moth measures about an inch across the expanded wings, is of a general bright yellow colour thickly mottled with fine black spots that form a number of somewhat irregular transverse lines towards the tips, but are more irregular near the body, which, as well as the thorax, is also spotted.

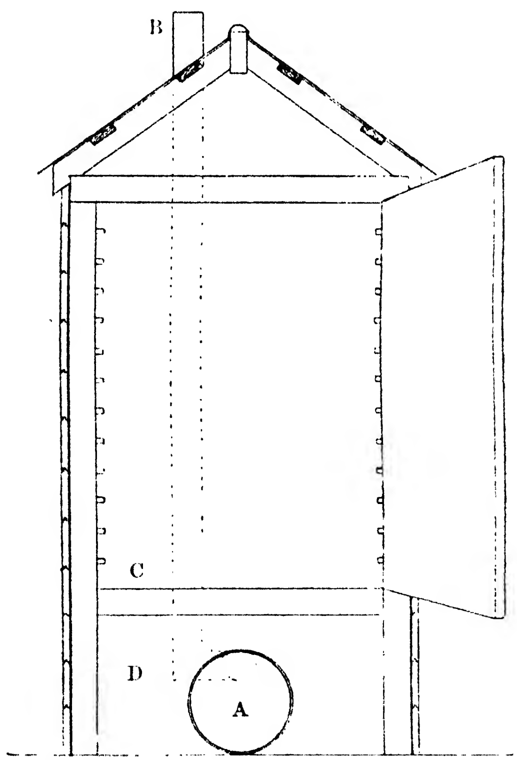
The presence of the grubs in the peaches can be detected by the gnawed hole and mass of castings loosely hanging together in a silken web round the opening. As soon as a withered peach is noticed it should be pulled off and destroyed, so that the caterpillars would not have a chance of turning into moths.

The caterpillars feeding inside the peaches could not be destroyed with any kind of spray. (See Plate, figs. 5 and 6.)

A Simple Fruit-dryer.

G. WATERS.
Hawkesbury College Orchard.

THE accompanying diagram shows a small home-made fruit-dryer that could be built by any handy man. The frame-work consists of hardwood, and the whole covering of either tongued and grooved seasoned boards or galvanized iron, though the boards are the better, as they do not coil so



quickly; but in many cases sufficient iron could be found about a farm to build one. The circle, marked A, represents the improvised furnace, made out of two oil-drums, taking the rim off one and forcing the one about an inch into the other; one of the tops or lids can be converted into a door. A hole

should be made in the end, and a small flue attached and carried above the machine, as shown at B. The bottom of the dryer, C, can be made out of iron, and should be perforated to allow the heat to rise from the air chamber, D. Cleats should be nailed on each side, as shown in figure, to slide the trays in and out on. The size of the trays should be 3 ft. x 2 ft., and twenty-four of these can be put into the dryer at once. The size of the dryer should be about 3 ft. x 4 ft. x 4 ft. inside measurements, and two doors, or, better still, one; but be sure and have every joint as air-tight as possible. This machine, of course, is only for beginners; but still by it a man can learn the rudiments, and, above all, permit a man to experiment at a small cost. On almost every orchard a certain quantity of peaches, apricots, plums, &c., get too ripe for shipping any distance, and yet are in a good condition for drying, and thus can be preserved.

In our drier district there is, of coure, no occasion to build even a machine like the foregoing, as the work can be done more easily and better by simple sun-drying.

Experiments with Sugar-beet.*

During forty years the object of our researches and experiments with sugar-beet has been to find out how to produce the beet most economically, taking into account the cost of manures, manner of cultivation, manipulation of the beet, and the extraction of its sugar.

At this present time, more than ever, the problem to be solved in agriculture is to lower to a minimum the cost of production. It is everywhere the same—in the vegetable as well as in the animal kingdom. To the solution of this problem we have devoted every energy, encouraged by the conviction that this particular agricultural industry must be retained at any price, and that the cultivator must go with the times, and choose the beet which produces sugar at the lowest cost, or be driven out of the market by his competitors. We have neglected nothing that will enable us to obtain accurate results. We have not only made innumerable experiments at the Cappelle Farm, but have studied the experiences in all other places, regardless of time and cost. We shall go into the development of these questions and publish the result in October, but in the meantime we give a *résumé* of a series of our experiments.

These results will excite considerably more interest from the fact that they are thoroughly reliable, and not only France, but the whole world, will be concerned more and more with the question of sugar production.

We fixed long ago the date of July 22 for the start of our work, and shall continue to follow the same rule, taking into account, however, that this year we have to face a quite abnormal situation, owing to the present very high temperatures, and the extreme drought now prevailing.

Recollect that our experimental fields are always made with the greatest regularity; the plants are placed at uniform distances, and the most minute care is given to them at the necessary times in order to arrive at exact results.

We have, as in previous years, chosen for our weekly experiments four different varieties of beet—well defined—which have been studied for a long time, and the origin and genealogy of which are perfectly known. In order that the results shall be as correct as possible, we take up each time in each field 100 beet plants on the same line. In order not to make our tables too complicated we only compare the results of this year with those of 1895 and 1890 (this last year having been a normal one for the growing of beet).

We give for each of the three years the average temperature of the atmosphere and soil, the quantity of rain in millimetres from the sowing-time to the sprouting of the seeds, the planting in rows, and the separating.

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* Agricultural Experiment Station at Cappelle, Department du Nord, France. Florimond Desprez, Director.

Average Temperature in the Shade.

	1890.	1895.	1896
Month of April...	8·04°	8·94°	7·87°
" May	15·10°	12·68°	11·74°
" June	15·86°	15·78°	16·40°
" July	16·20°	16·10°	17.56°

Average Temperature of the Soil.

1895.	Depth—4 in.	to 8 in.	1896.	Depth—4 in.	to 8 in.
Last 10 days in April ...	11·92° ...	12·35°	Whole of April ...	9·43° ...	9·21°
Month of May	13·43° ...	14·19°	" May	13·53° ...	13·75°
" June	17·82° ...	18·09°	" June... ...	18·17° ...	18·74°
" July (to 22nd)	17·05° ..	18·46°	" July (to 22nd)	19·46° ...	19·18°

The maximum has often attained 30 degrees at a depth of 4 inches, and 24 degrees at a depth of 8 inches, during July.

Average Rainfall in Millimetres.

	1890.	1895.	1896.
Month of April	2·28	1·55	0·99
" May	0·93	2·20	0.29
" June	1·07	0·94	1·72
" July (to 22nd)	5·11	2·00	1·35

Comparison between dates of Sowing, Sprouting, &c.

	1890.	1895.	1896.
Sowing	23rd April.	22nd April.	24th April.
Sprouting	15th May.	15th May.	15th May.
Placing	28th May.	28th May.	29th May.
Separating... ...	11th June.	20th June.	15th June.

SUMMARY of results obtained at the digging up, 22 July.

Average temperature in the shade during the last week, 17·53 deg. ; average rainfall during the last week, 0 mm. 04 ; average temperature of soil, 19·71° at 4 in. depth, 19° at 8 in. depth ; 100 successive roots in the same row taken from each experimental field.

Field No. 1.

	1890.	1895.	1896.
Weight of roots per square metre	0·763 kilos.	0·763 kilos.	0·925 kilos.
Weight of leaves " "	2·800 "	1·538 "	1·435 "
Density of juice at 15°	4·97	7·40	7·80
Percentage of sugar in juice	9·70	15·62	16·12
Quotient of purity	78·82	85·30	84·95
Production in kilos per hectare	7,630	7,630	9,250
Production of sugar per hectare	703 kilos.	1,131 kilos.	1,416 kilos.

Field No. 15.

	1890.	1895.	1896.
Weight of roots per square metre	1·232 kilos.	0·813 kilos.	0·988 kilos.
Weight of leaves " "	4·396 "	1·688 "	1·503 "
Density of juice at 15°	4·80	7·05	7·60
Percentage of sugar in juice	8·96	14·28	15·38
Quotient of purity	71·80	81·60	83·10
Production in kilos per hectare	12,320	8,130	9,880
Production of sugar per hectare	1,043 kilos.	1,103 kilos.	1,443 kilos.

Field No. 6.

	1890.	1895.	1896.
Weight of roots per square metre	1·112 kilos.	0·763 kilos.	0·856 kilos.
Weight of leaves " "	1·442 "	1·663 "	1·375 "
Density of juice at 15°	4·60	7·10	7·90
Percentage of sugar in juice	8·92	14·70	16·12
Quotient of purity	71·10	84·10	85·40
Production in kilos per hectare	11,200	7,630	8,500
Production of sugar per hectare	950 kilos.	1,064 kilos.	1,301 kilos.

Field No. 4.

	1896.
Weight of roots per square metre	0·800 kilos.
Weight of leaves ,, ...	1·565 ,,
Density of juice at 15°	7·60
Percentage of sugar in juice	14·92
Quotient of purity...	80·60
Production in kilos per hectare	8,000
Production of sugar per hectare...	1,133 kilos.

State of field, 22nd July.—The richness in sugar of the beet-root is normal, and the vegetation on our experimental fields has so far resisted the great drought; but if the rain does not come soon we fear it will suffer considerably.

29th July, 1896.

100 successive roots in the same row taken from each experimental field; average temperature in the shade from the 22nd to the 29th July, 17·41; average rainfall in millimetres during this period, 0 mm. 64; average temperature of the soil, 21° at a depth of 4 inches, and 20·30° at a depth of 8 inches.

Field No. 1.

	1890.	1895.	1896.
Weight of roots per square metre	0·875 kilos.	1·112 kilos.	1·131 kilos.
Weight of leaves ,, ,, ...	2·812 ,,	2·025 ,,	1·280 ,,
Density of juice at 15°	5·45	6·45	8·20
Percentage of sugar in juice	11·10	13·52	16·94
Quotient of purity	82·00	84·60	85·70
Production in kilos per hectare	8,750	11,120	11,310
Production of sugar per hectare	922 kilos.	1,428 kilos.	1,820 kilos.

Field No. 15.

	1890.	1895.	1896.
Weight of roots per square metre	1·628 kilos.	0·887 kilos.	1·318 kilos.
Weight of leaves ,, ,, ...	4·520 ,,	1·637 ,,	1·300 ,,
Density of juice at 15°	5·70	6·20	7·90
Percentage of sugar in juice	11·36	12·34	16·66
Quotient of purity	80·56	80·50	86·75
Production in kilos per hectare	16,280	8,870	13,180
Production of sugar per hectare	1,756 kilos.	1,040 kilos.	1,790 kilos.

Field No. 6.

	1890.	1895.	1896.
Weight of roots per square metre	1·408 kilos.	1·375 kilos.	1·031 kilos.
Weight of leaves ,, ,, ...	4·400 ,,	2·100 ,,	1·166 ,,
Density of juice at 15°	5·90	6·15	8·05
Percentage of sugar in juice	11·90	12·50	16·94
Quotient of purity	81·67	82·10	85·70
Production in kilos per hectare	14,080	13,750	10,310
Production of sugar per hectare	1,603 kilos.	1,632 kilos.	1,659 kilos.

Field No. 4.

	1896.
Weight of roots per square metre	0·875 kilos.
Weight of leaves ,, ,, ...	1·000 ,,
Density of juice at 15°	8·35
Percentage of sugar in juice	17·24
Quotient of purity...	84·70
Production in kilos per hectare	8,750
Production of sugar per hectare...	1,146 kilos.

State of Field, 22nd July.—Temperature, very high during day; maximum, 26 degrees; relatively lower during nights. Weight of roots: Average increase of 200 grammes per square metre. This increase is normal. The root is nicely shaped, and free from punctures of insects, &c. Some varieties seem to have difficulty in striking a tap-root. Richness of juice in sugar: Considerable increase, from 15·64 to 16·95 per cent. Weight of leaves: Diminution of 900 grammes per square metre. The leaves are, so to say, dried up and withered; they have the yellow colour of ripeness, but the petiole is still green. We cannot perceive any trace of disease.

General Remarks.

The drought is more intense than we have ever before experienced. Even in 1893, from April 1st to July 29th, we had an average rainfall of 1 mm. 67; but this year the corresponding average is only 1 mm. 01·. If this drought continues long, a very large portion of the leaves will fall; and when the wet season sets in, we fear that the shrunken state of the vegetation will cause a large diminution of richness in sugar.

1 hectare is equal to 2 acres 1 rood 35 perches.
1 hectare ,, 10,000 square metres.
1 kilogramme ,, 2¼ English lb.
1 metre ,, 39⅜ inches.
25·4 millimetres are equal to 1 inch.

5TH AUGUST, 1896.

100 successive roots in the same row taken from each experimental field; average temperature in the shade from the 29th July to the 5th August, 16·18; average rainfall in millimetres during this period, 2 mm. 29; average temperature of the soil, 18·78 at 4 in. depth.

Field No. 1.

	1890.	1895.	1896.
Weight of roots per square metre	0·912 kilos.	1·275 kilos.	1·240 kilos.
Weight of leaves ,, ,, ...	2·437 ,,	1·637 ,,	1·065 ,,
Density of juice at 15°	6·75	7·20	8·10
Percentage of sugar in juice	14·08	13·98	16·66
Quotient of purity	85·10	79·80	84·30
Production in kilos per hectare	9,120	12,760	12,400
Production of sugar per hectare	1,220 kilos.	1,693 kilos.	1,963 kilo

Field No. 15.

	1890.	1895.	1896.
Weight of roots per square metre	1·650 kilos.	1·787 kilos.	1·320 kilos.
Weight of leaves ,, ,, ...	4·895 ,,	5·137 ,,	1·450 ,,
Density of juice at 15°	5·90	5·70	7·86
Percentage of sugar in juice	12·04	11·36	16·12
Quotient of purity	82·63	80·50	84·98
Production in kilos per hectare	16,500	17,870	13,200
Production of sugar per hectare	1,192 kilos.	1,928 kilos.	2,020 kilos.

Field No. 6.

	1890.	1895.	1896.
Weight of roots per square metre	1·782 kilos.	1·062 kilos.	1·108 kilos.
Weight of leaves ,, ,, ...	4·730 ,,	1·475 ,,	1·045 ,,
Density of juice at 15°	6·00	6·55	7·85
Percentage of sugar in juice	12·04	12·82	16·56
Quotient of purity	80·30	81·10	86·76
Production in kilos per hectare	17,820	10,620	11,080
Production of sugar per hectare	2,086 kilos.	1,294 kilos.	1,742 kilos.

Field No. 4.

	1896.
The weight of roots per square metre is ...	1·187 kilos.
Weight of leaves ,, ,, ...	1·215 ,,
Density of juice at 15°	7·40
Percentage of sugar in juice	14·92
Quotient of purity...	82·70
Production in kilos per hectare	11,870
Production of sugar per hectare...	1,682 kilos.

State of Field.—The rains from the 30th July to the 1st August, have not been sufficient to force the growth of the beet-roots which continue to suffer from dryness; however, they seem to revive a little. Temperature: The night temperature is still very low, with a minimum of 7 degrees, which would be most suitable if we were in the last fortnight of September, but at the present time if continned it may cause serious losses.

[The degrees of temperature are most likely Centigrade scale, but may be Réaumur.]

Notes on Honey.

ALBERT GALE.

When Virgil said honey was "Heaven's gift, food fit for the gods," he must have meant gods celestial and gods terrestrial. Honey is as essential as salt for a food constituent. It contains both sucrose (cane sugar) and glucose (fruit sugar), not the manufactured article sold under that name, but the pure fruit sugars from Nature's laboratories. "Heaven's gift" is also more or less flavoured with the volatile oils of the flowers upon which the bees work; hence the justly celebrated honeys of Crete, Minorca, and Narbonne are due to the flavour of the volatile oils of rosemary. The ancients loudly sang the praises of the honey from Hymettus; its celebrated flavour was due to the oils of the flowers of thyme. The grateful flavour of the honey of Provens is produced from the flowers of lavender. The delicious flavour and pleasant aroma of Cuban honey is the result of the oil of neroli, which is obtained by the bees from the blossoms of the various members of the citrus family, chiefly that of the orange. Cuba, an island in size one sixth less than England, in one year exported honey and wax to the value of £130,000. This amount does not include the honey and wax consumed and used on the island.

Large quantities of honey, equally as palatable and containing as an agreeable an aroma as this justly celebrated Cuban article, is produced in this Colony, notably in that part of the county of Cumberland lying between Parramatta and Gordon, and also in other citrus districts of New South Wales. All that is required to obtain this far-famed honey for the market is a certain amount of care in the management of the hive during the honey-flow from the orange-trees. At the time these trees and other members of the same family are seen in blossom bud the bee-keeper should carefully examine every frame in the hive, and remove the winter storage that has not been consumed. It will not be found necessary to remove every cell of unused honey, more especially if the surplus supply is in colour a light amber. The oil of neroli is very penetrative, and its pleasant perfume will soon permeate the unused residue of the winter stock. As soon as the petals of the orange blossom are seen thickly on the ground, *i.e.*, when the young fruit have fairly set, no time should be lost in securing the harvest of orange-blossom honey. The almond flavour sometimes met with in the honey obtained from our fruit districts is entirely due to the volatile oils found in peach blossom and other stone-fruit. With care all these favourite flavoured honeys can be stored for market purposes. The worst part of it is, these valuable honeys come in during early spring, when they are largely required by the bees for raising the first brood of the season. Nevertheless, if the bee-keeper has not been over avaricious and extracted too closely before putting his bees up for winter, this drawback will not be there to contend with.

The honey of our native flora that is most appreciated is that from the white box (*Eucalyptus hemiphloia*), yellow box (*E. mellidora*), and the prickly tea-tree (*Melaleuca styphelioides*). Undoubtedly some honey from our native flowers is so strongly impregnated with eucalyptus flavour as to give one the idea that it is a compound medicament for coughs, colds, &c., and was never produced direct from Nature's laboratories. This inferior, strongly-flavoured bush honey is objected to by our brethren in the old country, and indeed by the public of New South Wales; but the honey with the flavours above-mentioned must ultimately become as popular and as much sought after as that of Crete, Minorca, Narbonne, or Cuba.

Honey is not only a valuable article of food, but is at once dietary, preservatory, medicinal, and a beverage. As an article of food, cheap as it is, there are few people use it to the extent it should be. As a preservative of fruit and other vegetable substances, it is one of the best mediums we have. It is frequently used in the arts for that purpose. It acts in the same manner as sugar. It is said the ancient Spartans used honey to preserve the dead bodies of their kings. The writer once saw the dead body of a mouse cut out from a jar of granulated honey. Whilst in a liquid state it had served as a medium of suicide for the unfortunate one. The body showed not the slightest signs of decomposition, although it must have been dead over twelve months. Honey diluted with about four times its volume of water, and exposed in an open vessel to the heat of the sun, produces a strong vinegar of a fine flavour. This vinegar is cheaply and easily made, and is equal, if not superior, to the malted article for pickling purposes. Honey, prepared with medicinal ingredients, forms an excellent medicated drink. The metheglen of the ancient Britons was fermented honey. Light or weak mead (another name for metheglen) is an excellent cooling summer drink.

The Grading and Branding of Meat with an Indelible Brând.

By The CHIEF INSPECTOR OF STOCK.

Even if we had not on a good many occasions heard it was the intention of the Imperial Government to pass a law compelling all meat, other than that produced in the United Kingdom, to be branded with an indelible brand to denote the country or colony from which it came, the following questions are deserving of careful consideration by our stock-owners and exporters of meat:—

1. Can frozen meat be branded with such a brand which, while it does no injury to the meat nor affects its appearance, is indelible, and at the same time both convenient and inexpensive to work?

2. If so, what would be the effect, so far as our stock-owners are concerned, of branding their beef and mutton which is intended for export with an indelible brand?

As, therefore, these are very important questions, I will, as briefly as possible, bring them under the notice of our stock-owners and exporters, with the view to their consideration and settlement, and in doing so I will offer no opinion with respect to them, but merely state some of the arguments which have been used for and against indelible branding.

1. Can a suitable Indelible Brand be found?

A brand of this description has, I believe, been patented by an inventor in New Zealand, and has been favourably spoken of; and there is no doubt but that, or some other indelible brand, would be got to answer the purpose if it were found that it would be advantageous to use such a brand on our meat. The brand to which I allude is impressed by making clean cuts on the red tissue of the meat before it is set, which opens when it does, and shows a very distinct legible indelible brand. It is simply an adaptation of the common mode which butchers adopt in ornamenting the cattle and sheep they kill.

2. How would branding our Meat for export with an Indelible Brand affect our Stock-owners?

1. *Arguments in favour of Indelible Branding.*—Those who advocate indelible brands on exported meat are, of course, in favour of official grading of the meat, and the following are some of the advantages which they claim for that system of branding:—

(*a*) It would make exporters much more careful than they are now as to the quality of the meat they ship, and they would no longer purchase inferior or even middling meat for export. This again, and the grading, they say would react on our stock-owners, who would be obliged to pay more attention to the quality of the fat

cattle and sheep they send to market, as they would then find that it would not pay to send inferior animals. The persons who take this view affirm that the principal reason for the low prices going for fat sheep in Australia, as compared with New Zealand, is the inferiority and unsuitableness of our sheep for the English market, and they point to the fact that while New Zealand sheep have been and even now are bringing paying prices in the home and London and other markets, Australian have, as a rule, been losing money.

(*b*) Having thus, by using indelible brands, brought about the improvement in the quality of the meat, till nothing but good and large proportions of really prime Australian beef and mutton are forwarded to the London and the British markets,—the advocates of this mode of branding assert that the result would be that the prejudice which now exists among the consumers in Great Britain against our frozen meat would soon pass away, and that better prices would be certain to be obtained. They do not, they say, imagine that the middlemen and retail butchers in London, who have all these years been systematically fostering this prejudice in order to get our meat pretty well at their own price,—would at once cease to run it down; but they think that if the quality is right their statements would, with indelible brands on the meat contradicting the opinions these interested parties expressed, soon fail to have any effect, the consumer would get good beef and mutton at reasonable prices, and our stock-owners, provided they put really prime beef and mutton on the market, would then get the principal share of the large profits which have, in many cases, been finding their way into the pockets of middlemen and retail butchers at Home, through this prejudice, while our stock-owners have both directly and indirectly been losing lots of money through the poor prices our meat has made in the London and other markets.

(*c*) Those advocating indelible branding further say that, although those now in the trade in England might be able at first to some extent to boycott the meat so branded,—if the Argentine exporters did not join with those in the Australian Colonies in branding with an indelible brand,—the Home Government would be ready as soon as they saw that branding with an indelible brand was practicable, to pass an Act making it compulsory in regard to all foreign and colonial meat; and that would oblige the Argentine exporter to use that description of brand.

(*d*) Branding in that way and grading would put the trade on a thoroughly honest footing, and that always pays in the long run.

2. *The Arguments against Indelible Branding.*—The opponents of this mode of branding say—

(*a*) That both the middlemen and retail butchers in England would be opposed to such a brand, and they would do all they could to prevent meat branded or marked in that way being sold at a price that would pay the shippers.

(*b*) With that view they say that these buyers would boycott the branded meat; and unless the Argentine shippers also adopted indelible brands on their beef and mutton, those in the trade in England would purchase Argentine meat and refrain from buying Australian unless at ruinously low prices.

How the Common Garden Snail (*Helix aspersa*) is spread about.

W. S. CAMPBELL.

This snail is an introduced pest which is spreading about our suburban gardens very rapidly. A few years ago it was almost unknown, but now it can be found in nearly every garden about Sydney. Frequently when walking into town in the mornings I notice some crawling about the city pavements. If everyone who has a garden would make some effort we might soon get rid of it; but, alas! there are but few who seem to take much notice of it, and quietly allow their plants to be destroyed without taking any steps to save them.

I had occasion lately to send to a garden for a few cuttings of a fibre plant to show some interested persons who called at the office. A day or two afterwards I discovered a snail on the wall of my room, and there it remains as an example. This caught my eye just now, and it struck me that it might be useful to caution persons in the country who may obtain plants or cuttings from Sydney to be on the look out for snails on the plants or cuttings. Not only by the medium of plants are the snails spread, but they are carried about unconsciously by persons on their clothing.

One day lately I saw a friend of mine looking into a shop window in King-street. "What on earth have you got on your collar?" said I. He put up his hand, felt round his collar, and pulled off a big snail. "Well, I never," said he, "it was only half an hour ago when I was walking up Hunter-street that a friend stopped me and said, 'What is that you have on your waistcoat?" Lo and behold, there was a huge snail! The fact is" he continued, "I went down to see the water-lilies in the Gardens, and I remained there standing on the grass for a considerable time. These rascals must have crawled up my clothes when I was standing there." This is an excellent illustration of the manner in which snails are easily carried about from place to place, and it is doubtless the same with many of the innumerable pests which infest our gardens and orchards. I have seen the "False ladybird," that abominable melon and pumpkin pest, carried along for miles in the country in a railway carriage.

Orchard Notes for March.

G. WATERS.

Most of the stone fruits will have been marketed ere this; only the late peaches, a few Japan plums, and pip fruits, such as late apples and pears, remain. Although the latter two, as a rule, are much easier to handle, still care must be used in the marketing of these fruits, and, where suitable varieties of peaches are grown, do not fail to dry and can or bottle all that it is possible; if not for market, put plenty by for home consumption during the winter and early spring months. Most of the late yellow-fleshed varieties are suitable for either purpose. By drying, a great quantity can be put away in a small space, and there are no bottles or cans to purchase, which is a great consideration.

Up to the present, high prices have not ruled for stone fruits this season, and if they have not brought money to the pockets of the growers, the prices have been instrumental in showing our apathetic growers the necessity for co-operation in each district, and the wisdom of growing varieties that will not only market well in a green state, but will also either dry or can, scores of which varieties exist.

I notice that in several districts the growers have been holding meetings to discuss the advisability of establishing factories in their several districts. Let us hope that before next season we will see many of these established.

A fairly good market exists for dried apples. During the month, as the varieties ripen, they should be attended to. Even the ones that are affected by Codling moth, even too far for marketing green or storing, can be turned into good dried fruit.

Care should be used in the picking of apples and pears, so that they are in the right stage. This important operation is one that sufficient attention is not paid to by the majority of growers, and yet is one that will pay growers to attend to thoroughly, especially when fruit has to be shipped any distance for marketing at once, or storing for marketing later, or export.

No hard and fast rule can be laid down for the best time to pick, this being gained by actual experience; but we can go this far, and say that apples, especially late ones, should be allowed to remain on the tree until they are fully grown, so that they develop their true size and flavour, which will mature when stored.

Pears, on the other hand, should not be allowed to ripen fully on the trees. The best flavour is obtained by ripening off the tree.

Do not allow an opportunity to cultivate to escape, especially in the late-ripening fruits, as it enables them to ripen better, in addition to keeping down weeds.

The remarks on scale insects in last month's notes apply equally to this month. Any trees requiring spraying that have not been done should be attended to at once. The kerosene emulsion is the best, but do not apply to a tree that is making young growth.

Where citrus trees are intended to be planted this coming season get the land into thorough order. Do not be mean in the preparation of it. Plough and break up deeply; every effort in this direction will be amply repaid. Do not fail to drain also if necessary. On our coastal districts citrus trees often give the best results if planted in April, especially so if we have some nice showers. Planting then gives them a chance to get good roothold before the winter.

Secure your trees now, or, rather, bespeak them, and plant only the best varieties. Within the last few years some magnificent oranges have been introduced, and there is no doubt that new blood is necessary among our citrus trees. Many of the old varieties have quite degenerated, and should be replaced by new ones. Among the best oranges are Washington Navel, which should be planted in good rich soil; Valencia Late, a splendid late hanging variety; Mediterranean Sweet; and Jaffa.

The same remarks about oranges apply also to lemons and mandarins.

Vegetable and Flower Growing.

Directions for the Month of March.

Vegetables.

Asparagus.—Prepare some land by trenching 18 inches or 2 feet deep, and let this remain to settle down before planting, which may be done in the winter or spring before the shoots have started into growth.

Beans, French or Kidney.—Sow a few rows in the warm districts of the Colony.

Beans, Broad.—Sow a few rows 2 to 3 feet apart. Drop the seed in the rows 4 to 5 inches apart, about 3 inches deep.

Beet, Red.—Sow a little seed in rows.

Beet, Silver.—Sow a little seed in well-manured ground.

Borecole or Kali.—Sow a little seed for transplanting.

Broccoli.—Sow a little seed in a seed-bed.

Cabbage, Brussels Sprouts, Cauliflower, Broccoli, Savoy.—Sow seed and plant out good seedlings from the seed-beds.

Celery.—Sow a little seed and transplant from seed-bed any plants that may be large enough.

Cress and Mustard.—Sow a little seed.

Endive.—Sow a little seed in a seed-bed.

Herbs.—Sow seed of various kinds.

Lettuce.—Sow seed in a seed-bed.

Leek.—Sow a little seed, and, if plants are available from former sowings, plant out.

Peas.—Sow a few rows.

Raddish.—Sow a little seed from time to time.

Sea-kale.—Sow a little seed.

Spinach.—Sow a little seed, and afterwards transplant the seedlings when large enough.

Shallots and Garlic.—Plant out bulbs in rows about 1 foot apart.

Flowers.

Plant all kinds of spring flowering bulbs—Daffodils, jonquils, anemones, tulips, ranunculus, ixias, hyacinths, snowdrops, &c., &c.

Plant out violets, daisies, cowslips, primroses, polyanthuses, auriculas, pansies, and hardy annuals and perennials of all kinds.

Sow seeds of ten-week stocks for transplanting out.

Sow seeds of hardy annuals and perennials.

Cuttings of roses, pelargoniums, fuchsias, geraniums, and other plants will strike readily this month. Water sometimes and shade, but be careful not to over-water.

General Notes.

Reduced Railway Rates for Artificial Manures.

Some time ago Mr. W. H. Grear, of Bowral, wrote to the Department respecting the carriage of small lots of artificial manure, and the matter was brought under the nofice of the Railway authorities. We are pleased to announce that the Commissioners, with the object of encouraging farmers and fruit-growers who wish to use small quantities of fertilisers, have approved of parcels of artificial manure, not exceeding the maximum indicated in the table given below, being charged single-package rates.

It is, however, to be understood that the parcels must not be of such an objectionable character as would preclude them being carried with other goods.

Rates for Single Packages.

Butter, Honey, Eggs, Cream, Milk, Cheese, Fruit, Canned Fruit, Jams, Vegetables, Garden Produce, and Wine, the produce of the Colony,

On the Up Journey,

And Seed Potatoes, and Seeds of all kinds,

On the Up or Down Journey.

The undermentioned scale of mileage rates will be charged for any single package containing butter, honey, eggs, cream, cheese, fruit, canned fruits, jams, vegetables, garden produce, and wines, the produce of the Colony, conveyed on the Up Journey; and seed potatoes, and seeds of all kinds, on the Up or Down Journey, when the weight does not exceed that specified as follows:—

Miles.	Package not exceeding 90 lb.	91 lb. and not exceeding 112 lb.	113 lb. and not exceeding 140 lb.
	s. d.	s. d.	s. d.
Up to 50 miles	1 0	1 0	1 0
51 to 100 „	1 0	1 3	1 6
101 to 200 „	1 9	2 3	2 6
201 to 300 „	2 3	2 9	3 3
301 to 400 „	2 6	3 3	3 9
401 to 500 „	2 9	3 6	4 3
501 to 600 „	3 0	3 9	4 6
Each additional 100 miles	0 3	0 3	0 3

In the case of potatoes only, when the bag or package weighs over 112 lb., but does not exceed 170 lb., the charge will be at the scale shown for 140 lb.

In the case of cream or milk, the rate applicable to a package not exceeding 90 lb. will be charged for any single can of 10 gallons capacity containing cream or milk.

Should there be more than one package in a consignment, each package will be charged as above, unless the charge by weight at the classified tonnage rate for the article is cheaper, subject to the usual minimum freight charge.

The through mileage to or from Branch lines to be taken for charge at the single package rates.

The package rates will apply when sent from any station on the Corowa line to any station on the South-Western or Jerilderie lines.

It may be mentioned that this arrangement, which it is hoped will prove a boon to agriculturists, came into operation 1st January.

"Shad Scale," "White Sage" or "Sweet Sage." (*Atriplex canescens*, James.)

The Director of the Botanic Gardens informs us that he has received from Prof. Lamson-Scribner, of the U. S. Dept. of Agriculture, a small quantity of the seed of the above plant. It was formerly one of the chief reliances of the cattle-men on the arid plains from Western Texas to Arizona, United States, but has now become almost extinct, occurring only on steep cliffs and in protected situations where cattle and sheep cannot reach it. It is not likely that the plant is of greater value than many of our salt-bushes, nevertheless it is worthy of trial by progressive pastoralists. Applications for a small sample may be made by squatters in the Western Division who are willing to give it a trial and report results.

Experiments with Woolly Aphis, or American Blight.

Mr. J. B. Reymond, M.P., of Forbes, forwards the following particulars of some experiments he has conducted with the object of discovering some effective means of ridding his apple-trees of American Blight:—

"With us the worst pest which attacks our apple-trees is the 'American Blight.' For years I have tried to find a way of getting rid of it. I have tried sulphate of copper, sulphate of iron, sulphur, kerosene, castor oil—in fact, all the remedies and nostrums I read of or heard about. I varied the strength of the doses and the time of application, and always failed. I believe my cures agreed well with the "*Aphis lanigera*," for my apple-trees became whiter, more gnarled, and less productive year by year. At the end of last May I had the earth removed from round the trees to a depth of 8 or 9 inches, and for about 2 feet from the trunk, taking care to have an inch or so left to protect it. In this basin, with a diameter of about 4 feet, I placed a pound of dead wool soaked in kerosene. Where any roots had been laid bare I had them covered up with a little earth before putting in the wool. The basins were filled up again and a narrow strip of sheepskin, soaked in castor oil, was tied around the tree a foot above the ground. The wool and kerosene were to kill the aphis in the ground, and if any of them should escape and attempt to go up the tree, they were to be stopped by the castor oil. Had I not failed so many times before, I would feel inclined to exclaim, 'Eureka,' I have found it at last. My trees are nearly clean, but last season was a very dry one, and the drought may have had as much to do with the disappearance of the aphis as my kerosene and castor oil and wool. Still, I think that much credit cannot be given to the drought for the good done, for the apple-trees were well watered. Let it be as it may, I consider the experiment worth following up, and I hope some other orchardist will try it. I may be asked why I used dead wool. Rags chopped fine would very likely answer as well; but last season made dead wool plentiful and cheap, and that is why I used it.

"Here is another experiment, which, to my mind, is nearly conclusive. Some time ago I read, I believe, in the *Agricultural Gazette*, that in the Island of Cyprus a vineyard presented this pecularity, that, whilst nearly the whole of it was badly suffering from phylloxera, one end of it was entirely free from the pest. This immunity could only be accounted for by the fact that at the end of the vineyard there was a row of sumac trees, and that the sumac leaves, when they fell, were gathered round the vines and dug in. If I remember rightly, the virtue of the leaves in warding off the attacks of phylloxera was attributed to the quantity of tannin they contain. I made up my mind to try what they would do against 'American Blight,' as I have a few sumac trees, of which for years I had vainly tried to get rid. I allowed the leaves to get fully ripe, so that they would contain as much tannin as possible, and, having gathered a bagful, I buried them round an apple-tree which the 'American Blight' had nearly killed. The year following the burying of the leaves no change showed in the tree, and I made sure I had added another failure to my many previous ones. The next year, however, the 'American Blight' disappeared. Now, this tree is one of four growing close together, and all as bad, the one as the others, with the pest. I think there is a strong presumption that the sumac leaves have brought about the difference that there is now between the tree round which they were buried and the other three which are as bad with 'American Blight' as they can be. I will carefully gather this season all the sumac leaves I can get, and put them round as many of the other trees as the quantity gathered will warrant.

"I may as well state that these four trees were not treated with the dead wool and kerosene.

"In speaking of my former experiments, I said that I had tried kerosene and found it useless. After removing some earth from round the trees, I had poured varying quantities of the oil on the ground and covered up. Round some other trees I had poured an emulsion of kerosene and soft soap. Why kerosene used that way should be useless and be effective when put in with dead wool or rags or peat moss, I cannot say. I take things as I find them; somebody else may give us the rationale of the thing. All experimenters are, I think, groping more or less in the dark; if they stumble across something of value, it matters little whether they have done so by accident, and whether they can explain why the thing is valuable."

Dairy Farms in Holland.

The attention of *Gazette* readers is drawn to the following remark in Messrs. Smith and Trepplin's report on Dairy Farms in Holland:—

"The buildings are kept scrupulously clean; though it can hardly be believed, it is not an uncommon event to see a farmer slip his wooden sabots off before going into his cow-byre, in order that the floor, the bricks of which are polished like a mirror, should not be soiled."

It cannot be doubted that the scrupulous attention paid to hygienic precautions largely accounts for the high price obtained for Holland and Friesland butter—the special property of which is good keeping quality.

AGRICULTURAL SOCIETIES' SHOWS, 1897.

Society.	Secretary.	Date.
Dapto A. and H. Society	A. B. Chippindall	Jan. 6, 7
Albion Park A. and H. Association	H. Fryer	,, 13, 14
Gosford A. and H. Association	W. McIntyre	,, 29, 30
Wollongong A. and H. Society	J. A. Beatson	Feb. 3, 4
Cobargo A., P., and H. Society	T. Kennedy	,, 16, 17
Ulladulla P. and A. Society	C. A. Cork	,, 16, 17
Berrigan A. and H. Society	R. Drummond	,, 17
Riverina P. and A. Society (Cereal)	W. Elliott	,, ——
Manning R. (Taree) A. and H. Association	H. Plummer	,, 18, 19
Lithgow A., H., and P. Society	J. Asher	,, 18, 19
Robertson Agricultural Society	R. J. Ferguson	Mar. 2, 3
Bega A., P., and H. Society	J. Underhill	,, 3, 4
Southern New England (Uralla) P. and A. Association	Jas. Lecce	,, 9, 10
Tumbarumba P. and A. Society	W. Willans	,, 9, 10
Tenterfield Intercolonial P., A., and M. Society	F. W. Hoskin	,, 10, 11, 12
Coonabarabran P. and A. Association	E. May-Steers	,, 11
Oberon A., H., and P. Association	A. Gale	,, 11, 12
Berrima District (Moss Vale) A. H. and I Society	J. Yeo	,, 11, 12, 13
Cobargo A., P., and H. Society	T. Kennedy	,, 16, 17
Crookwell P. and A. Association	W. P. Levey	,, 18, 19
Lismore A. and I. Society	T. M. Hewitt	,, 18, 19
Walcha P. and A.	F. Townsend	,, 23, 24
Cudal A. and P. Society	C. Schramme	,, 24, 25
Blayney A. and P. Association	J. Clements	April 1, 2
Mudgee A. P. H. and I. Association	J. Cox	,, 6, 7
Liverpool Plains (Tamworth) P., A., & H. Association	A. M'Leod	,, 6, 7, 8
Warialda P. and A. Association	W. B. Geddes	,, 7, 8
Williams River A. and H. Association	W. Bennett	,, 7, 8
Cooma P. and A. Society	D. C. Pearson	,, 7, 8
Orange A. and P. Association	W. Tanner	,, 7, 8, 9
Royal Agricultural Society	F. Webster	,, 14–20
Moree P. and A. Society	S. L. Cohen	,, 21, 22
Hunter River (West Maitland) A. and H. Association	W. C. Quinton	,, 28, 29, 30
Hay Hortic. Society	J. Johnston	May 5
Namoi P. and A. Association (Narrabri)	J. Riddle	,, 5, 6
Upper Manning A. and H. Society	W. Dimond	,, 12, 13
Upper Hunter P. and A. (Muswellbrook)	J. C. Luscombe	,, 19, 20, 21
Northern Agricultural Association	C. Poppenhagen	Sept. 1, 2

Secretaries of Societies are asked to forward dates of forthcoming Shows as soon **as decided.**

[2 plates.]

Eragrostis falcata, Gaud.

Useful Australian Plants.

BY J. H. MAIDEN.
Government Botanist and Director of the Botanic Gardens, Sydney.

No. 36.—THE FALCATE LOVE-GRASS (*Eragrostis falcata*, Gaud.)

Vernacular Names.—I know of none. Grasses of the genus *Eragrostis* are sometimes (one can hardly say popularly) termed "love-grasses." The adjective "falcate" may be prefixed by way of distinction.

Botanical Name.—*Eragrostis*, from two Greek words, *eros*, love, and *agrostis*, grass, hence the name love grass, an allusion, Paxton says, "to the beautiful dancing spikelets" (inappropriate in the particular species under notice). *Falcata*, adjective, from the Latin *falx*, *falcis*, a sickle; used in botany to denote anything curved, in allusion to the curving of the spikelets.

Botanical Description (*Flora Australiensis*, vii, 649).—A slender, tufted, glabrous grass, varying from a few inches to about 1 foot high.

Leaves narrow, convolute, erect.

Panicle narrow, usually secund, slightly compound, 2 to 4 in. long.

Spikelets sessile or nearly so, crowded or clustered along the short branches, very narrow, nearly terete, often curved, from 4 to 5 lines to 1 in. long and about ½ line broad, with twelve to fifty or even more flowers, the rhachis scarcely articulate.

Flowering glumes closely appressed, scarcely 1 line long, obtuse, hyaline at the end, the keel and a lateral nerve on each side very prominent.

Palea rather shorter, curved, persistent.

Styles slender.

Grain ovate, flattened.

Value as a Fodder.—Isaac Tyson, quoted by Mueller, states that it is one of the best pasture-grasses in arid tracts in sub-tropical Western Australia. Such a statement is, of course, only comparative, for the grass is by no means of the highest merit. It is a small grass, wiry in appearance, with small leaves; nevertheless, it affords useful feed until it is burnt up by summer droughts. Much of the plant consists of inflorescence, and it produces seed readily.

Habitat and range.—This grass is found in all the colonies except Tasmania. It is an interior species in most of the colonies, although it comes near the coast in the south-western part of the continent. It is common both on the far inland plains and also on the sand-ridges that skirt them.

Reference to Plate.—A. A typically falcate spikelet; B. Flowering glume, showing three prominent nerves.

A

No. 37.—The Hastate-leaved Salt-bush (*Rhagodia hastata, R.Br.*)

Vernacular Name.—Frequently this is known by the name of "Salt-bush," *the* Salt bush, or "the smaller Salt-bush," in comparison with the "Old Man" (*Atriplex nummularium*). The name, hastate-leaved, is suggested merely for the sake of precision.

Botanical Name.—*Rhagodia*, from the Greek *Rhax*, a berry, a characteristic of the fruit of the genus. *Hastata*, Latin, a spear, in allusion to the shape of the leaves.

Botanical description (*Flora Australiensis*, v, 156).—A procumbent or divaricately-branched undershrub, spreading to 2 or 3 feet, green or slightly mealy-white when young.

Leaves opposite or rarely alternate, petiolate, ovate-hastate, or almost rhomboidal, very obtuse or emarginate, the basal lodes short, obtuse, or rarely acute, under 1 in. and often under ½ in. long.

Flowers small, clustered, usually in compact, simple, or slightly-branched spikes, either terminal or in the upper axils and shorter than the leaves, rarely more slender and elongate.

Perianth divisions oblong, not contracted at the base or stipitate, as in *Chenopodium triangulare*, which this species sometimes resembles.

Fruit ½ to ¾ line diameter, usually red.

Value as a Fodder.—It is a useful fodder-plant, being readily eaten by stock, and having the advantage of being readily propagated. It is believed to be very nutritious, but we have no specific data by which to assess its absolute or relative value in this respect.

Other uses.—This is a small bushy shrub, attaining a height of 4 or 5 feet. Its neat habit and its pretty little hastate leaves, mealy white, give it a most dainty appearance. It grows from cuttings as readily as willows, and will stand any amount of clipping. Mr. W. A. B. Greaves, of Bondi, has shown the value of this plant for decorative purposes. He made an edging of it, for which it seems particularly adapted, and, in a warm climate, I do not call anything to mind that excels it in neatness and prettiness for the purpose stated. Specimen shrubs may also be clipped into all shapes by those whose taste lies in this direction.

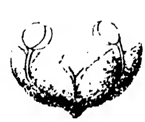
The foliage always feels cool to the touch. From an æsthetic point of view, the only objection I can offer to this salt-bush as a cultivated plant is its odour, which resembles that of not perfectly fresh fish. The smell, however, is not obtrusive, and is only noticeable if the leaves be placed against the nose, or crushed in the hand.

Attention may here be invited to the photograph, *Agricultural Gazette*, Sept., 1896, p. 611, of a fine plant of this species, six months from a cutting, grown by Mr. George Valder, of the Murrumbidgee Experiment Farm.

I have grown the saltbush for some years, and can bear testimony to the readiness with which it grows at nearly all times of the year, and it stands ill-usage far better than most plants.

Insect Pests.—This is one of the saltbushes attacked by a species of scale (*Pulvinaria Maskelli*, Oll.). See an illustrated article by the late Mr. Olliff—"A new Scale-insect destroying Saltbush" (*Agricultural Gazette* ii, 667, 1891). See also an article "Further remarks on the Saltbush scale" (*Pulvinaria

A



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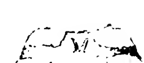


C

Rhagodia hastata, R. Br.

"A Salt Bush."

(116 54 - 97.)

Maskelli, Oll.) by the same author, iii. 176 (1892), in which further particulars are given concerning this pest, figures of the scale-insect being given, together with a scale-moth and a lace-wing fly, which both prey upon the pest and tend to keep it in check.

Habitat and Range.—It is found in the colonies of Victoria, New South Wales, and Queensland, varying in size of plant, shape, and texture of leaves in different districts. In our own colony it occurs not only in the coast districts, but also on the northern table-lands, and away to the north-western plains. Overstocking and travelling sheep are driving it more into the interior, except on islands and other protected situations.

Reference to Plate.—A, Portion of branchlet with flowers; B, Staminate flowers; C, Fruit.

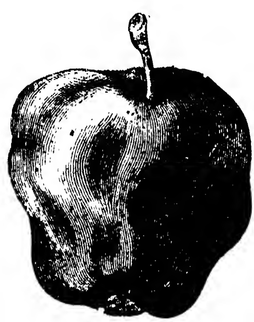
Cause of an Important Apple Disease.

By N. A. Cobb.

In 1892 the receipt of some peculiar-looking diseased apples caused me to insert the following note in the *Agricultural Gazette* :—

An Obscure Disease.

"The adjacent wood-cut illustrates an obscure disease of the apple, which appears to be rather common. Such apples are worthless. They are of irregular growth, and the pulp is neither fit for table use nor for cooking, being too hard and often bitter. Whether the disease is of insect or fungus origin, is unknown to me. Information, accompanied by specimens of the disease, when possible, will be welcome."



Apple caused to be misshapen and worthless through some obscure disease.

The examination recently of some similar-looking deformed apples sent me from Orange and from Galston, N.S.W., appears to throw some light on the cause of this disease.

The appearance of the apples is shown on the accompanying plate reproduced from a photograph of a few apples taken from the case sent me.

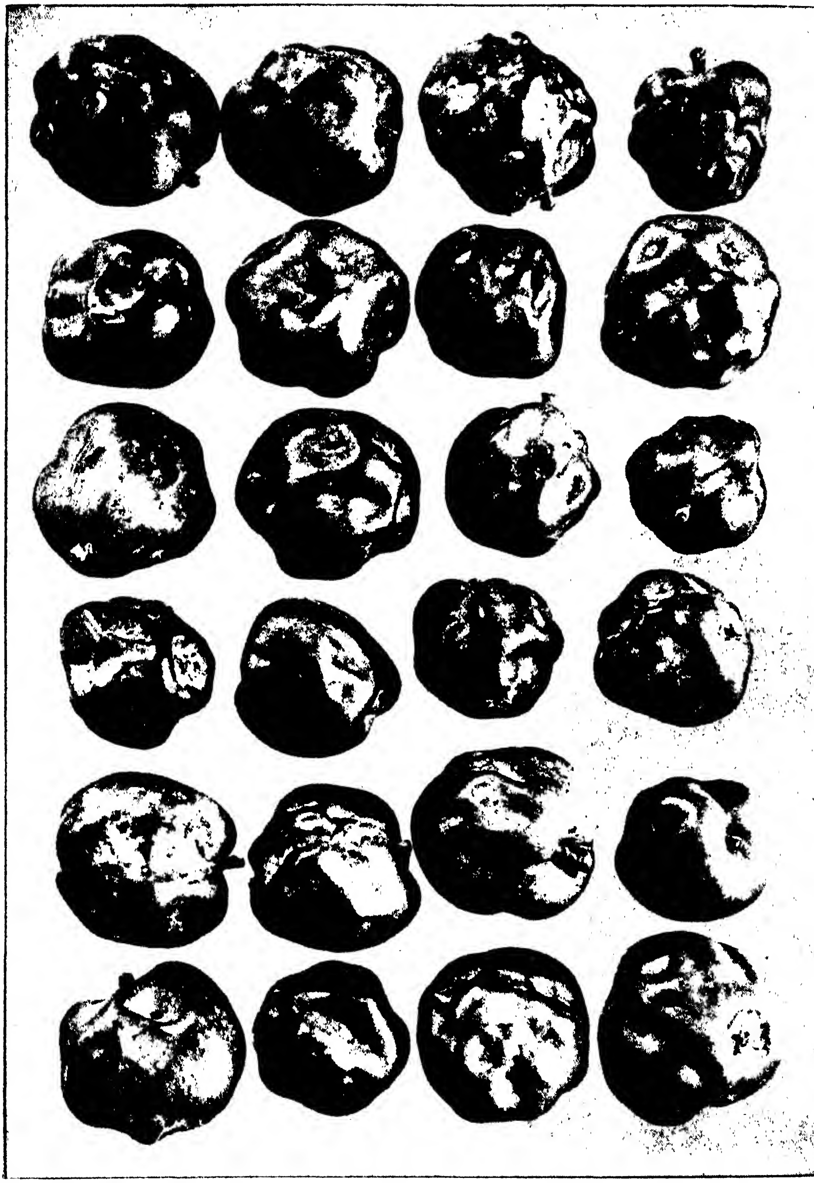
I found upon examination of these apples, which were very good material for the purpose, that they were attacked by three insects,—

I. The codlin moth, about 10 per cent.
II. The mussel scale, about 2 per cent.
III. The woolly-aphis, all, or 100 per cent.

This result naturally leads to the suspicion that the woolly-aphis is the cause of the deformities.

The aphides are uniformly located near the eye of the apple, *but are inside* (namely, in the passage leading to the core, and in exceptional cases in the core itself), and number from two or three to a dozen or more. Some are alive, but some are long since dead. They show in a lesser degree the woolliness characteristic of the species as well as other anatomical features. Drops of a transparent colourless or honey-yellow liquid, covered with adhering waxy material, are common among these aphides.

The occurrence of aphides in this situation cannot be a fact that is well known, no special mention of such a fact being found in the literature of



Collection of Apples affected Internally by the Common Woolly Blight.

(Two-thirds natural size.)

apple diseases. The statement is made, apparently on the authority of Prof. Prilleux, that the woolly aphis is found on almost any part of the tree, but the fruit is not specifically mentioned.

While the uniform occurrence of aphides inside the apples, in this case, strongly suggests that they are the cause of the deformity, it by no means explains *how* the deformity is caused. We are driven to theorize.

It is well established that certain insect punctures cause deformities closely resembling those under discussion. The apple curculio, for instance, puncturing the young apple, and depositing its egg in the hole thus made, causes deformities, inasmuch as the apple fails to grow in the neighbourhood of the puncture. The plum curculio works with similar results on plums and apples. An insect puncture therefore *can* cause such deformities as those shown on the apples from Orange and Galston.

Can the woolly-aphis puncture? Yes, that is its main business in life, and what is even more to the point, we know that on roots and limbs the results are unsightly malformations caused by the punctures. This was shown by Prof. Prilleux twenty-five years ago.

Our aphides however are found *inside* the fruit. How then did they cause these malformations which are to all appearance of external origin?

Is it too much to suppose that when the apple was a blossom, or at least young, it was punctured by aphides which afterwards found their way into the cavity of the apple's eye? This theory needs to be tested, and fortunately the experiment will be easy. Next spring place an abundance of these insects on some blossoms and young apples, specially mark the apples, and await the result. It will be necessary to isolate the insects, which can be done by tying cotton-wool round the base of the blossoms. &c. These insects will, until they become winged, be unable to pass such a barrier.

It is conceivable that the aphides can cause the malformations by their raids on the interior of the apple, but this is less likely, as appears from the fact that *some* of the malformations are far distant from the eye of the apple, where the insects are located. (See plate.)

I hope this note may lead to the solution of this mysterious and so-called "obscure disease," which it will be seen is one of considerable importance.

The red spider also occasionally occurs inside apples in the channel leading from the eye to the core, but I have seen no evidence that this mite causes deformities.

Some Useful Observations on Germinating Wheat.

By N. A. COBB.

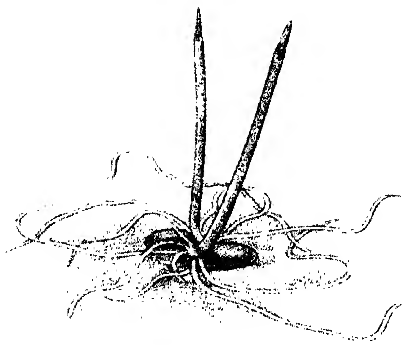
In February, 1896, my attention was drawn to the purple colouration in the sheaths of some shoots of germinating wheat grains. Noting that the variety was one having purple straw, *i.e.*, one whose straw turns from green through purple to brownish yellow in ripening, I began to wonder if this purple colour on the first shoot of the germinating grain was correlated with that of the straw. Some experiments were made at once, and they soon demonstrated that there is such a correlation.

These tests and observations, carried out largely at the Government Experiment Farm at Wagga, New South Wales, are now first placed on record, and relate to the following varieties of wheat:—

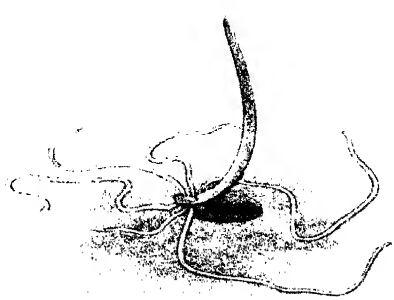
Thomas' R.R.
White Fife
Leak's R.R.
Northern Champion.
Sicilian Square-headed Red.
Darblay's Hungarian.
Bearded Hérisson.
Anglo-Australian.
Fultz.
Hedgerow.
Rieti.
Talavera de Bellevue.
Ward's Prolific.
Dallas.
Battlefield.
Improved Fife.
Saskatchewan Fife.
White Velvet.
Marshall's No. 3.
Little Club.
Frampton.
Early Para.
King's Jubilee.
Australian Talavera.
Red Straw.
Velvet Pearl.
Rattling Tom.
French Early Bearded.
Robins' R.R.
Canning Downs R.R.
White Lammas.
Early Baart.
White Naples.
Steinwedel.
Allora Spring.
Farmer's Friend.
Zealand.
Oakshott's Champion.
Steer's Early Purple Straw.
Blount's Lambrigg.
Marshall's No. 8.
White Essex.
Fillbag.
Pringle's Defiance.
Golden Drop.
Hudson's Early Purple Straw.
Grosse's Prolific.
Dutoits.
Gore's Indian.
Brown-eared Mummy.
Algerian.
Poland.
Belotourka.
Medeah.

This list includes the varieties of wheat principally grown for flour, in this, as well as other countries. There need be no mistake about the exact nature of the samples tested, if reference be made to the descriptions published in the *Agricultural Gazette* of New South Wales, 1893, pages 431 to 471, where these varieties are as fully described as the limits of our knowledge then permitted. The results herein presented thus rest on a definite basis, because the names of the samples tested represent definite varieties in a state of purity.

Each variety was germinated by itself in a wine-glass, by the aid of a sufficient quantity of pure water. The water was made to nearly cover the seed, and was replaced from time to time according to the amount



PURPLE STRAW.



NOT PURPLE STRAW.

Wheat-grains Germinating.

of evaporation. The observations made on these various samples showed conclusively that the grains of a purple-strawed variety of wheat, when germinating under these simple conditions, almost without exception reveal their identity by the purple colouration of the first shoot. (See coloured plate.)

Under favourable conditions the purple colour first shows itself in about forty-eight hours after the grains are placed in water, though it may be delayed another twenty-four hours. By first soaking the grain for fifteen minutes in water of 120° Fahrenheit, and then germinating in cold water to which a very trifling amount of ashes is added, the whole process may be considerably hastened and the purple colouration be made to appear sooner.

I frequently have to identify samples of wheat for wheat-growers and others, and have, on several occasions during the last year, found this simple test to be very useful in such cases. It need hardly be pointed out that this test is one that can be applied by buyers and millers to distinguish samples of purple straw wheat from others. Thus of two samples of grain offered at the same price, I believe it safe to say that, other things being equal, it would be best to take that which showed the fewest purple shoots on being germinated. This test is so simple that I expect to see it widely made use of in such cases. Inasmuch as Australian wheat is at present composed largely of purple-strawed varieties, this test may also be of use in the London market as a criterion in doubtful cases, and I therefore venture to invite attention to this aspect of the test.

The second useful observation made at Wagga in connection with germinating wheat arose out of the first, and is also one that can be easily utilised by farmers, merchants, and millers. While observing the germination of the various varieties, I noted that some shot forth and grew more rapidly than others, and of course at once suspected that these were the early varieties, and that turned out to be generally the case.

This test is one that can be carried out simultaneously with that for purple straw, and its utility rests on a similar basis. Just as the purple strawed wheats have been shown, more particularly by Mr. Guthrie, chemist to this Department, to be on the whole productive of flour of inferior nutritious quality, so the early wheats have on the whole turned out to be inferior in the same respect to the mid-season and late wheats. The test for earliness is therefore one that can be made widely useful, and to some extent for the same purposes.

It is to be noted, however, that this latter test is one that is often seriously interfered with, or even vitiated by the condition of the seed. I find it to be of comparatively little value unless the tests are made on samples of equal quality as regards size, plumpness, age, condition, &c. It will be seen therefore that this second test, both for purposes of identification and quality of the grain is less useful than the first.

Perhaps I ought to add that the particular purple colouration referred to in this article should not be confounded with a certain purplish cast acquired by some wheats through a pigment formed in the cuticle. The peculiar purple which has given their name to the purple straw varieties is due to those physiological changes in the *contents* of the cells which take place along with the dissolution of the chlorophyll in ripening tissues, and is seen not in wheat alone but in a wide range of plants.

A Method of Using the Microscope.

By N. A. COBB.

I MUST ask the forbearance of the purely agricultural readers of the *Gazette* while I devote a page or two to the description of a piece of apparatus which has enabled me thousands of times to give them advice about the treatment of their crops, either by letter or through these pages. I refer to the microscope. The *Agricultural Gazette* is chosen as the medium for my communication because it has a circulation extending over the whole world, and more particularly because it reaches agricultural experts wherever located.

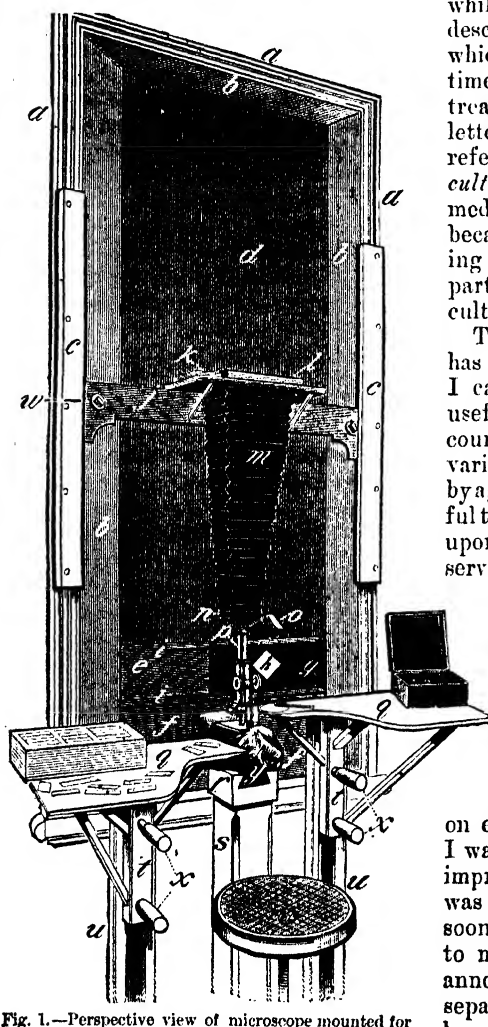


Fig. 1.—Perspective view of microscope mounted for purposes of investigation by daylight. Dimensions may be gauged by the diameter of the top of the stool, *v*, which is 1 foot.

The apparatus I have to describe has been so very useful to me that I cannot but think it will be also useful to others in this and other countries, engaged as I am on the various scientific problems presented by agriculture, and if it turns out useful to them even the farmer who looks upon this technical article as of no service to him will, whether he knows it or not, be indirectly benefited.

This method of mounting and using a microscope is one that has been gradually perfected through almost daily use since 1888. I have frequently been asked to publish the details, and have so far refrained from doing so only because I found that on each new microscope mounted I was enabled to make a number of improvements, and so long as this was the case any description would soon be antiquated and so become, to me at least, only a source of annoyance. On no less than ten separate occasions has this device been remodelled to suit differing circumstances, and it now stands in five laboratories under my supervision, viz., Sydney, Moss Vale, Wagga, Bathurst, and Pymble.

The following is a key to the illustration (Fig. 1):—

aaa, architrave of a window facing the sun.

bbb, ½-inch runners, 4 inches wide, in which the blind, *d*, slides.

cc, runners for the arm, *j*, which carries the camera, *m*.

d, perfectly opaque blind, made of American leather or enamelled cloth, running on a spring roller at the top of the window. By raising this blind the whole apparatus may be flooded with sunlight if necessary.

e, a ¼-inch board, 8 inches wide, hanging in an inch-deep slot in the board, *f*, and riveted to the blind, *d*, and hence rising and lowering with the blind. This board, *e*, slides in the runners, *bbb*.

ff, an inch board, 8 inches wide, fitted to the side of the window and receiving the board, *e*, into a median slot ¼ inch wide, and 1 inch deep in its upper edge.

g, two sliding pieces of thin ebonite, placed one behind the other, each with a diamond-shaped opening cut out in the middle. By sliding these ebonite shutters the opening, *h*, can be made of various sizes.

ii, the runners in which the two ebonites, *g*, slide. Behind the ebonites an elongated opening is cut in the board, *e*, and this opening has a ground glass sliding over it in runners similar to *ii*, but fastened to the back side of *e*. All these latter appliances are for the purpose of varying the amount and character of the light coming through the diamond-shaped opening, *h*.

j, wooden arm, 1 inch thick and 3 inches wide, carrying the micro-camera, *m*, and sliding in the ways, *cc*, capable of being clamped by the set-screws, *w*. Any position of *j* may be recorded by means of scales marked on *cc*.

k, photographic plate holder, half-plate size, as used on an ordinary tripod camera.

l, frame into which the slide, *k*, is pushed, in construction similar to the back of an ordinary tripod camera.

m, leather bellows of micro-camera, capable of extension to 4 or 5 feet.

n, wooden front or head of camera, into which the barrel of the microscope fits. This head is hollowed out, and carries a light ebonite shutter, actuated from the outside, by means of which the exposures are made. The wire lever actuating this shutter is shown as a dotted white line near *n*. (See also Fig. 2).

o, mirror of the Abbé camera lucida.

p, barrel of the microscope.

qq, vertically sliding tables, the right-hand one being used as a drawing-board when the camera lucida is in use. Being adjustable, various magnifications can be secured. The higher *q* is placed the less magnification the drawing will show. A scale drawn on the architraves enables any position of *q* to be registered. The left-hand table is similarly adjustable, and is usually kept on a level with the microscope stage. Both these sliding tables are cut away to suit the observer's body resting on the stool, *v*. Both are braced so as to be quite rigid under the weight of the arms in drawing, &c.

r, head into which the foot of the microscope is firmly clamped by means of easily removable wooden wedges.

s, pillar bearing the microscope, preferably of iron and planted in cement beneath the building, and coming through the floor without contact with the building. If this is not feasible, *r* may be fixed to the window-sill. In three of my laboratories the ways, *cc*, are fixed to iron or wooden beams, also planted in the earth and coming through the floor without contact, thus making a very perfect arrangement for long photographic exposures with high powers where all tremor must be avoided.

tt, halves of wooden hand-clamps of large size (15 inches long and 2½ inches square), grooved to slide in the ways, *uu*, and carrying the well-braced tables, *qq*.

uu, two wooden table-ways, firmly fastened to the side of the building.

v, stool.

w, set-screw, to clamp the camera in position.

xx, four set-screws, to clamp the tables, *qq*, in position.

y, opaque cloth, sewed on to a rectangular opening cut in the board, *f*, to admit the light to the mirror of the microscope. Slots to hold coloured glasses are arranged on the back side of this opening, to furnish mono-chromatic light for photography, &c. The various substage adjustments can be worked through the cloth, which, however, can be lifted in a second when necessary.

After having made the different features of the drawing (Fig. 1) clear, it will only remain to explain some of the advantages of this system of utilising the microscope. Having used the microscope, for purposes of investigation, almost daily for nearly twenty-five years, I feel justified in calling particular attention to opinions based on such extensive experience.

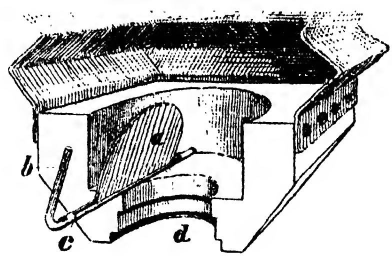


Fig. 2.—Section of head of microscope camera, one-half size—*a*, vulcanite shutter; *b*, arm or lever for opening and shutting the shutter *a* (this arm is outside the head); *c*, slot into which *a* is set; *d*, rabbited opening into which the draw-tube of the microscope fits in a light tight manner.

The apparatus is adapted to the best of all lights,—daylight. The perfection of the image as formed on the retina of the eye is very great, for if the room be darkened, and the blind, *d*, be closed, no light but that from the microscope enters the eye. Few, even among experts, according to my observations, realise the evil effects of extraneous light when observing with the microscope. Those who do realise this evil are usually found advocating the use of artificial light by night so as to avoid the evil. Here is a way to avoid it and still keep to the use of daylight. It need scarcely be pointed out that the cloth, *y*, is for the purpose of excluding extraneous light.

The window faces the sun, so that whenever it is desired, by simply raising the blind, *d*, sunlight can be obtained on the top of the stage as well as under it.

The whole apparatus is quite rigid.

The arrangement for drawing with the camera lucida is of a high degree of perfection. I am often struck with the complication of the various more or less expensive devices, always more or less imperfect too, attached to the camera lucida, as now made, and having for their object the graduation of the light, so as to equalise the lights coming from the object and the drawing-paper respectively. This object is usually accomplished by inserting between the drawing-paper and the eye a glass having the correct neutral tint. It is usually found that the exact tint required cannot be obtained, either because the properly tinted glass has been lost or broken, or never existed. In any case, such glasses are in the way, and can only have been regarded as a necessary evil. In the system here described, the light coming through the microscope is first graduated so as to be as perfect as possible, then the diamond-shaped opening, *h*, is set so as to exactly equalise the lights coming from the microscope and from the drawing-paper located on the circle under the pencil shown in the illustration. This can be done in an instant and with the utmost precision. The ground glass behind *h* serves to destroy the image of outside objects which are formed when the aperture *h* is reduced in size. The difficulty of using the camera lucida with very high powers is well known. With this system there is no difficulty; whatever can be clearly seen can be drawn.

When the left-hand table, *q*, is arranged on a level with the microscope stage the moving of objects on to and off the stage is conveniently accomplished.

The sliding adjustment of the drawing board, or table (right-hand *q*), will commend itself at once to anyone who has used a camera lucida. Already a number of patents exist on this head, but all that I have seen are lacking in stability and convenience. Here, however, the artist may lie stretched at ease, and, having so adjusted the drawing-board as to secure the desired magnification, can work with comfort and with great precision.

The nice working of the fine adjustment is facilitated by the fact that the ball of the hand may at the same time rest on the table.

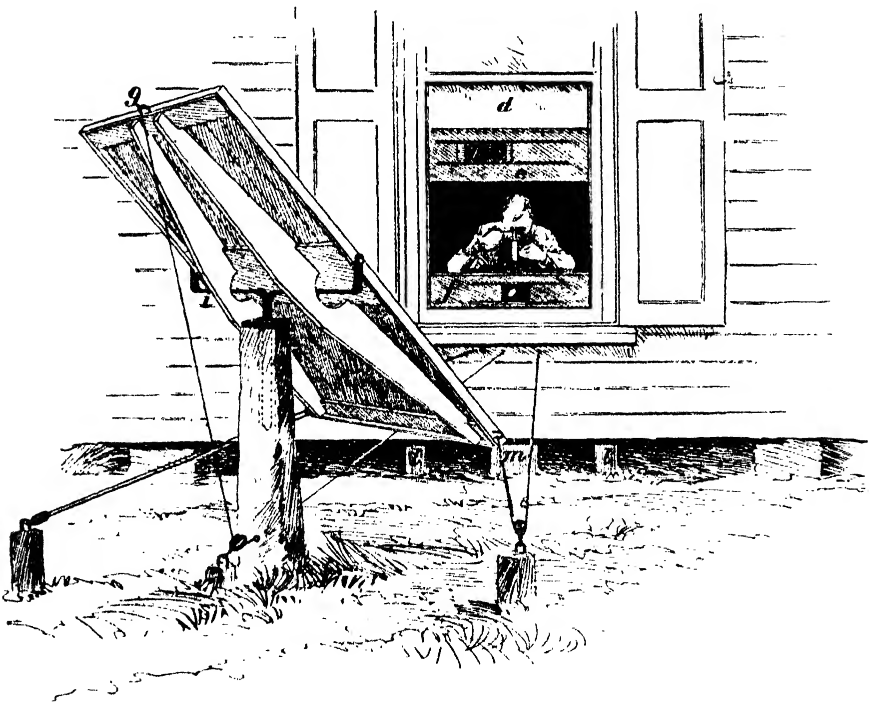


Fig. 3. Back view of white screen having universal movements; *d*, *e*, *f*, and *h*, same as in Fig. 1—that is, *d*, opaque blind; *e*, quarter-inch board, 8 inches wide, attached to *d*, and rising and falling with it; *f*, inch board, 8 inches wide, top of which is slotted to receive *e*; *h*, the same diamond-shaped opening shown in Fig. 1; *g*, top of screen; *i*, forked wrought iron spindle, shown black, except where it enters the post,—the dots show its continuation; *ll*, uprights imbedded in the ground and passing up into the building without touching it, and supporting the microscope-camera above the operator's head; *m*, pillar supporting the microscope, imbedded in the ground, and passing up into the building without touching it. The cords and pulleys are for the purpose of moving the screen from inside the building. The small mirror mentioned in the text is placed on the front of the screen near *g*.

The microscope can be clamped in position, and is movable within limits.

The photographic camera is in readiness for instant use, and is as rigid as possible. Being arranged on a vertical system, it is most convenient. Few, I imagine, having once fairly tried a good vertical system will ever revert to any other. Its advantages are obvious. For instance, the stage remaining horizontal, the object does not tend to float and get out of focus, liquid backing

on the plate does not flow, the focussing can be most easily and accurately done, especially when the ground glass is dispensed with, and a lens used instead, the bellows never bothers by sagging when long drawn out, and so forth, and so forth. My whole apparatus is made as low as possible, so that in focussing on the ground glass at *l* it is only necessary to stand up. If the camera has to be extended to 5 feet, it will be necessary to provide steps, as *l* thus comes up above the head of the standing operator. The focussing lens can rest on the ground glass, or swing on a vertical pivot fastened into the frame, *l*, or be carried on a rackstand resting near *k*.

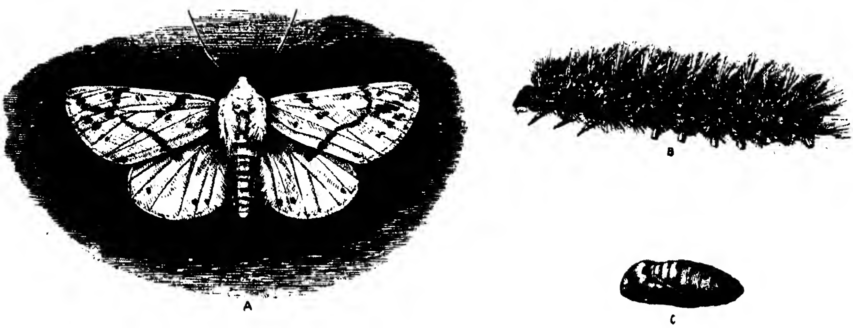
For long focusssing, when it is inconvenient to reach the fine adjustment with the hand, I use a stick, the end of which carries a piece of metal that fits into a slot filed in the top of the fine-adjustment screw. When the adjustment is secured, the stick is removed. This convenient arrangement has often enabled me to take photo-micrographs with great rapidity.

The pillar, *e*, forms a model support for a dissecting stand, the tables, *qq*, being then placed at equal heights to serve as arm-rests.

The light is obtained from a white screen, having universal movements, placed outside in the sunlight, and workable from the interior by means of cords and pulleys. The screen is a board frame covered with bleached sheetting. On one end of the screen is a small mirror, so fastened as to indicate, by the sun's reflection, when the screen is reflecting the maximum amount of sunlight. This light reflected from the screen is superior to the proverbial white cloud, and eclipses any artificial light.

I feel sure that, in the right hands, the appliances I have here described, if patented, could be made a source of profit, and the moral right to so use them is hereby freely given to whomsoever chooses to accept.

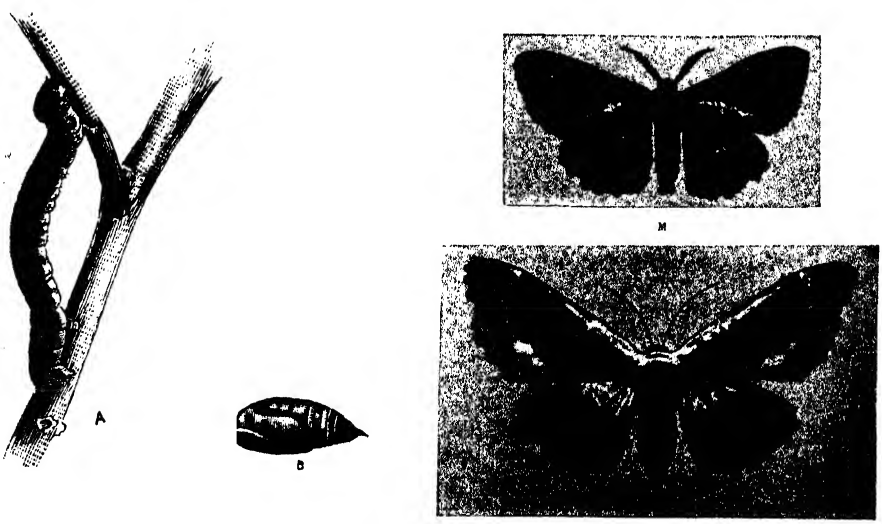
It is with much pleasure that I acknowledge the aid, during the last few years, of Mr. E. M. Grosse in executing a number of the details of this system of using the microscope. The accompanying illustrations are from his hand.



The Light Ermine Moth.

(*Pilosoma obliqua*, Walker.)

A. Moth. B. Caterpillar. C. Chrysalid.



The White-shouldered Looper.

(*Lophodes sinistraria*, Gn.)

Caterpillar. B. Chrysalid. M. Male moth. Lower one, female.

Forest Moths that have become Orchard and Garden Pests.

WALTER W. FROGGATT,
Government Entomologist.

The Light Ermine Moth (*Pilosoma obliqua*, Walker.)

This is a common moth in the gardens about Sydney, but from its delicate colouration and retiring habits is seldom seen in the daytime unless disturbed. The caterpillars are omnivorous in their tastes, feeding upon many garden-plants. Early last October they attacked the foliage of the sunflowers, feeding upon the under-side; at first only gnawing holes in them, but as they increased in size completely stripping the leaves, clustering together beneath them when at rest.

The full-grown caterpillars may frequently be seen crawling along the paths, and are always in a great hurry to get out of sight.

The caterpillar until about half-grown is of a general dark-brown colour, thickly covered with tufts of long brown hairs, springing from a transverse row of raised warts, varying from 6 to 12 in number. The head is reddish brown, small, lobed on either side, and rounded with a vertical line down the centre of the face, meeting a light yellowish-brown dorsal stripe running down the centre of the back to the tip of the abdomen.

The sides of the body are much lighter coloured than the back, with the under surface dull brown; the segments of the body are rather bigger in the middle than towards the tip, with the 3rd, 4th, 5th, and 6th abdominal ones furnished with a pair of prolegs; the anal claspers being short and stout.

The full-grown caterpillar is about 1¾ in. in length, and is stout and thick; its immature hairy coat is replaced with a dense covering of long black hairs, which lie so close that the light-coloured dorsal stripe is hidden; with the exception of the distinctly-marked head, it is a black "woolly bear," very different in appearance to the caterpillar in its younger stages of development. After feeding for six weeks in captivity, the first pupated on the 7th of December. The pupæ measure ¾ of an inch in length, and are enclosed in light-brown, loosely-spun, flimsy silken cocoons, very often placed side by side on the food-plant. The pupa is broad and stout in proportion to its length, of a dark-brown colour, thickly covered with fine punctures, which are very irregular on the upper portion, but forming regular rings on the abdominal segments; the last segment terminates in a curious brush-like tip.

The moth measures slightly under 2 inches across the outspread wings, which together with the head, thorax, and under-surface of the body are creamy white; the eyes and antennæ are black, the latter finely toothed, and tapering to the extremities; the sides and front of the face are thickly covered with bright red down, with a patch on either side on the under

surface at the base of the forewings, and the thighs of the same bright colour, the rest of the legs black. The wings are very irregularly spotted and marked with blackish brown; on the fore pair there is generally a fine band of these spots running from the tips of the wings at an angle towards the base; the hind pair are sometimes hardly spotted at all. The upper surface of the abdomen is bright red with a row of black spots down the centre of the back, and another on either side, the latter curving round underneath; the under surface of the abdomen and the extreme tip are creamy white.

Mr. E. Anderson in a paper in the *Australasian* says, "This is one of our commonest moths (in Victoria), and appears early in September. Apparently there are three or more broods during the year. The caterpillars from the September moths are full fed in November, and emerge into moths in December. By the end of February another generation has passed, and yet another by May, the caterpillars from the last series feeding slowly through the winter, and producing the September moths."

Remedies.—Spraying with Paris green when the young caterpillars are feeding together, and have not abandoned their gregarious habits. They are very easily shaken off the bushes, and can be brushed into a dish and destroyed; if the September brood be destroyed it would be the most effective.

The White-shouldered Looper (*Lophodes sinistraria*, Gn.).

A fine collection of caterpillars of this moth were received from Mr. W. A. Smith, of Moorebank, in December and another in January, with the information that they had stripped all the foliage off a number of young apricot trees in his orchard before their depredations were noticed.

Mr. Geo. Lyell informs me that in Victoria these caterpillars feed upon the foliage of the black wattle (*Acacia decurrens*), and in some places are very plentiful; they probably, in their native state, feed upon the same trees in New South Wales, but I have never taken them about Sydney.

The eggs, which were also obtained by Mr. Smith and forwarded with the caterpillars, are placed side by side in regular rows on the upper surface of the leaf; they are dark yellow, cylindrical, and elongated, varying from 140 to 160 in number, but each patch could be easily covered by a sixpence.

The caterpillars, when full-grown, measure 1½ inches in length, and are of the usual elongate slender cylindrical form peculiar to this group; the general colour is dark reddish-brown, closely covered with fine transverse bands of darker coloured spots. The head is somewhat lighter in colour, with the under surface of it and the thoracic segments tinted with rich pink; the forehead is very flat, giving the head an angular or ridged appearance. The apex of each segment has three wrinkled folds, more distinctly defined towards the tip; the legs are light coloured with the claws black; the spiracles yellow; the third pair of prolegs broad; the tip of the abdomen ornamented with three conical points, the central one smallest.

The remarkable resemblance of most of the looper caterpillars, both in colour and form, to the twigs of their food plant, and the motionless attitudes they assume when disturbed or resting, render them, even when full-grown, very difficult to detect; it is only after the plant is pretty well stripped and the cause of the damage closely investigated that the marauders are discovered. Though their movements are so precise, the fore part of the body being always stretched out and the leaf in front clasped with the fore-legs before the centre of the body is looped up and the hind claspers let go

behind, yet they can get about very quickly, and are further aided by carrying a silken thread from the mouth with which they can drop when frightened.

The pupæ are shining black to dark chocolate brown, and, like all members of this family, are not enclosed in any cocoon but deposited among the rubbish beneath the tree; they could be easily collected and destroyed if the caterpillars have been overlooked. They measure about an inch in length, but vary considerably in the sexes; the male chrysalids are much the smaller; the summit rounded, the wing cases short and roughened, with the abdominal segments covered with fine punctures and divided at the base with a smooth impressed ring, the anal one very rough, rounded at the tip, and ornamented with a fine fork.

The moths vary much in size and colouration in the sexes. The males measure only a little over an inch and a-half across the wings, which are of a general blackish-brown colour, indistinctly marbled with irregular transverse black lines, several grey spots on the front margin of the forewings and others on the hind pair; both pairs deeply crenulated along the edges. The antennæ are very fine and deeply feathered. The female measures over two inches across the wings, which are of a much lighter colour than those of the males. The ground colour is somewhat variable, generally of a light chocolate brown, with the front margins of the fore pair striped with grey running across in a band behind the head; two small spots towards the tips. The remainder of the wings have several fine irregular lines, the last one marking the crenulated edges with dark brown. The hind pair have three dark lines, forming a broad band across the centre and another dark band round the lower edges. When at rest they spread their wings out, forming a half-circle, and lie so closely to the bark that they are very easily missed in spite of their size.

Remedies.—Spraying with Paris green will soon destroy them, as they are most voracious feeders; while if the ground be well raked up beneath the trees, many chrysalids will be destroyed.

Some South Australian Forms of *Cordyceps Gunnii*, Berk.

By J. G. O. TEPPER, F.L.S., &c., and D. M'ALPINE, Govt. Veg. Pathologist, Victoria.

Among the entomogenous fungi of Australia, *Cordyceps Gunnii*, Berkeley, is probably the most widely distributed, and, as is frequently the case with such species, exhibits a considerable variation in form. It is therefore of importance to record the various forms so as to discover the limits of the variations on the one hand, and on the other to trace out possible connections between these and localities, conditions, or other circumstances which may have a bearing upon their biological history, which is the *raison d'etre* of the present paper.

The species was first described from Tasmanian specimens (*Berkeley Dec. Fung.* 200, *Fl. Tasm. II*, 278. *Sacc. Syll.* 5030, *&c.*), then from Victoria and New South Wales (*Cooke, Handb. Austr. Fungi, p.* 277, *fig.* 184, 1892; *Olliff, Agric. Gazette, N. S. W., Vol. VI, p.* 408, *Plate IV, fig. A*), in various localities. The latter author also quotes "South Australia" but without giving any specified locality or authority, the present record is therefore the first which denotes these, and places the occurrence of the species in that province beyond doubt. The same author also mentions that the record from New Zealand requires confirmation.

If the figures published by the above-mentioned authors be compared with those in the appended plates, and drawn from fairly fresh specimens by us, it will be seen at once how great the difference in form and size really is, and not alone in that of the vegetable part but also in that of the host. In regard to the latter the opinion may be expressed that in the case of the South Australian specimens the form of the larvæ is such that its belonging to the genus *Pielus* appears doubtful, and may rather belong to members of the families *Lasiocampidæ* or *Agrotidæ*, &c., that is, larvæ feeding above ground, but descending into it when moulting or pupating, as some species do. If this surmise be correct, it would also explain how infection could occur in favourable localities, the spores being evidently scattered at or near the surface, the underground-feeding larvæ living habitually at too great a depth and rarely if ever come to the surface or approach it, as that would endanger their life exceedingly.

The description given in Cooke's Austr. Fungi, p. 277, is as follows:—"Entomogenous, fleshy, capitulum cylindrical, yellow, becoming blackish above; stem elongated, white; asci cylindrical; sporidia filiform, breaking into cylindrical joints, 5 μ long, hyaline." This being quite insufficient to include our specimens, and in some respects inapplicable, the following supplementary one is drawn up instead.

Cordyceps Gunnii, Berk.

Entomogenous; capitulum simple, variable from elongate oval to cylindrical, punctate, black to yellow, 21–42 mm. long, 6–13 mm. thick; basal part of stroma distinct, cylindrical, more or less carinate, brownish, 7–35 mm. long, 3·5–7 mm. thick; stem short or considerably elongated, straight, more or less contorted or spirally twisted, usually much more slender than the basal part of the stroma, external cortex-like part thickened, rough, surface irregular, dark brown, loosely adherent, more or less incrassated towards apex; internal part fibrous, white; 45–240 mm. long, 2·5–7·0 mm. thick. Plate I, figs. 1–5. (J.G.O.T.)

Perithecia pale yellow, Indian-club-shaped to broadly clavate, perfectly rounded at apex or slightly apiculate, completely immersed, with slightly swollen dark-brown collar at oval end, which dehisces by a narrow pore, up to 1·5 mm. in length, and visible to naked eye; wall elastic and tough, 9·5 μ thick.

Asci hyaline, elongate, narrowly cylindrical, tapering slightly toward capitate end, and considerably towards the posterior, constricted beneath capitate apex, 300–500 μ long, and 8-spored.

Sporidia arranged in parallel bundles within the asci, filiform, fairly equally thick throughout, but the ends slightly tapering and rounded, at first multiguttulate, then multiseptate, 155–169 × $2\frac{1}{2}$ — 4 μ; component cells $4\frac{1}{2}$ — $5\frac{1}{2}$ × $3\frac{1}{2}$ — 4 μ, readily separating and not stained by iodine. Plate II, figs. 1–5.

On comparing specimens with published descriptions (I have chiefly used Massee's in Annals of Botany, Vol. IX, No. XXXIII, p. 18, 1895), and authenticated forms in the Melbourne Herbarium, I find the figured specimens to belong to *C. Gunii*, but the amended description will serve to call attention to variations probably due to difference of habitat. The capitulum may be elongate ovate, lanceolate, sub-cylindrical or cylindrical, the colour black as well as yellowish, and its size may be 2–4 cm. instead of 4–8 cm. The stem is very variable in length, and may be dark brown as well as whitish or rich olive green, as, Olliff says, they are in life. The average length of the entire fungus (inclusive of the caterpillar) of several specimens in the Melbourne Herbarium is $5\frac{1}{2}$ inches, but one with long, slender, flexuous stem was about $2\frac{1}{2}$ times that. The perithecia are often clavate as well as narrowly ovate, the asci cylindric, without being clavate, and the capitate end (clavate) towards the mouth opening; the sporidia agree with the recorded sizes, but are by no means as long as the ascus.

These South Australian forms deserve to be placed on record for comparison with Tasmanian, New South Wales, and Victorian specimens, but I do not think the external characters are sufficient to separate them (from the others) being so variable. (D.M'A.)

Habitat.—On lepidopterous larvæ, South Australia. Four specimens were collected by Mr. Gratwick and sent by Mr. A. Siddell at Sellick's Hill, and three others at Kingston, by Dr. A. Engelhardt.

Those specimens furnished with the longer and thinner stems bear also the smaller capitulum, and *vice versa*, while either group include both straight and spiral-stemmed forms, and appear to be similar in all respects, except size.

The caterpillars all belong apparently to the same species, but are too much distorted for identification. They are from 35-50 mm. long, and 4–5 mm. thick, and mostly similarly encrusted (wholly or partially) as the stem of the fungus. The latter was described by the donors as having been

found among grass under trees in very rich black soil during wet weather, but the kind of trees was not mentioned. The occurrence in black soil is also recorded by Olliff, but the trees (*Acacia elata*, Cunn.) with which his informant stated, they were always found associated do not occur in S.A., nor is even the allied *A. decurrens* indigenous at Sellick's Hill (32 miles south of Adelaide), though it may be at Kingston.

EXPLANATION OF PLATES.

Plate (J. G. O. Tepper).

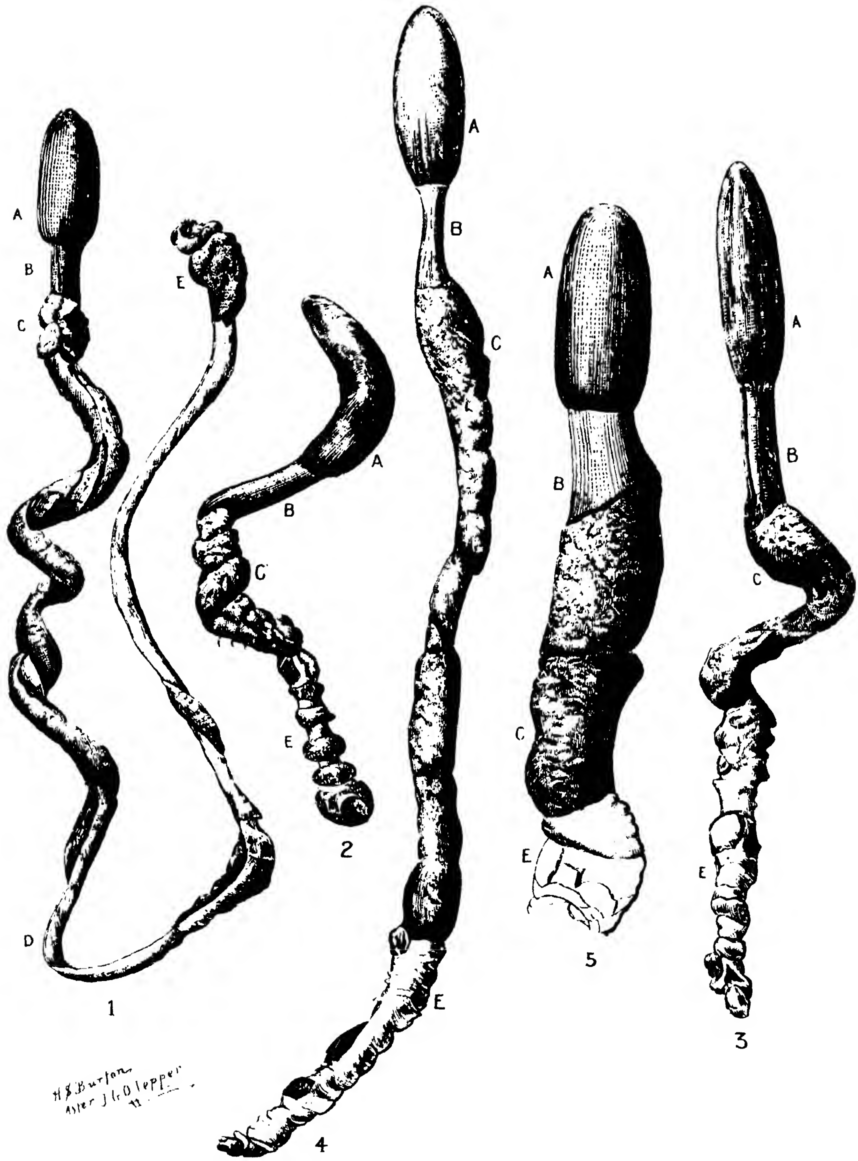
Figs. 1 5. Cordyceps Gunii, Berk. Natural size. Drawn by J. G. O. Tepper.

Fig. 1. Sellick's Hill specimens (legit Mr. Gratwick). Slender, elongated form.
,, 2. ,, ,, (,,). Stouter form, smallest specimen (others intermediate).
,, 3, 4. Kingston specimens (legit Dr. Engelhardt). Normally-sized forms.
,, 5. Sellick's Hill specimen preserved in spirit. - Stout form and somewhat magnified A. Capitulum. B. Neck or Stroma. C. Rough, external epidermis covering stem. D. Internal white fibrous stem exposed by removal of outer part. E. Caterpillar, more or less distorted by the fungus.

Plate (D. McAlpine).

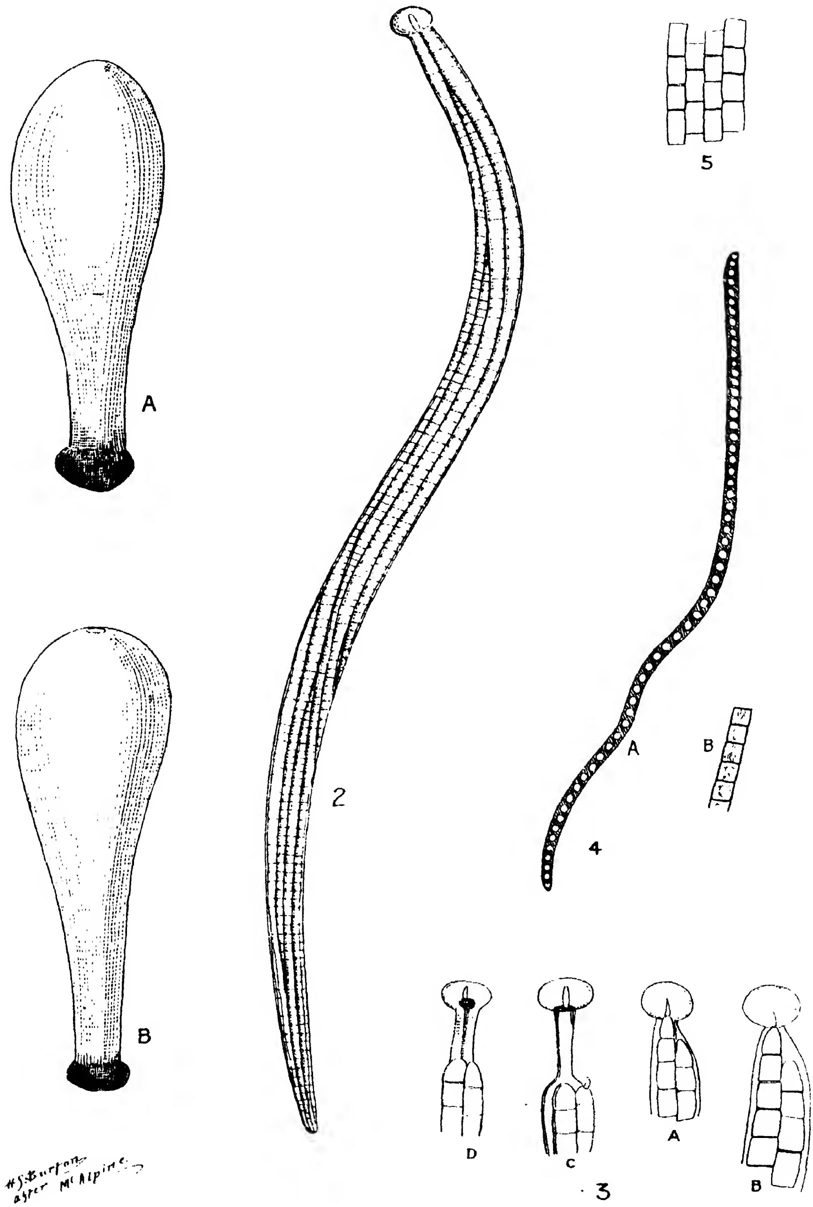
Figs. 1-5. Cordyceps Gunnii, Berk. S.A. varieties. Micros. details. Drawn by D. McAlpine.

Fig. 1. Two Perithecia × 52. A. Size, 1·128 mm. ; B. Size, 1·450 mm. long.
,, 2. Ascus ; × 540. The asci are usefully gracefully curved, thickest about the middle, and tapering towards the posterior extremity ($312\,\mu \times 9{\cdot}5\,\mu$).
,, 3. Capitate end of asci ; × 1000. A–D. Varieties of form.
,, 4A. Sporidium at multiguttulate stage ; B. Portion of another at multiseptate (× 540).
,, 5. Middle of ascus (× 1000), showing four sporidia on superficial view.



Cordyceps gunnii, Berk.

(11b 54-97.)



(11b 54-97.) Cordyceps gunnii, Berk.

*Report on the Manufacture of Soft Cheese.

(*Camembert and Brie.*)

BY M. DE MÉTALNIKOFF, Attaché to the Russian Minister for Agriculture, and M. V. HOUDET, Agricultural Engineer and Professor at the Dairy School of Poligny.†

General Remarks.

IN the dairying industry, as in most others, the quality of the products depends on the quality of the materials we have to commence with.

The principal requirement in the making of good cheese is an abundant supply of good and rich milk.

The milk to be used for the making of soft cheese should contain nearly equal proportions of fat and casein; if it is too watery, like that from the Dutch herds, the cheese becomes dry and hard; if, on the contrary, it is rich in butter, like that from the Jersey cattle, the cheese has a tendency to run, will easily go rancid, and is difficult to keep.

In making Camembert and Brie the milk from the Normandy and Flemish herds, which give from 3,000 to 3,400 litres‡ of milk during the 300 days of milking, is preferred.

The following tables give the composition of a mixture of milk from eighteen cows, drawn night and morning, and which was analysed by the method of M. Duclaux of the Agricultural School at Coigny:—

	January 16.		July 6.	
	Solids.	Liquids.	Solids.	Liquids.
	gr.	gr.	gr.	gr.
Fatty matter	4·18	0	3·48	0
Lacteous matter	0	4·68	0	4·71
Albuminoid matter	3·47	0·63	3·01	0·59
Phosphate of Lime	0·23	0·17	0·15	0·20
Mineral Salts	0	0·31	0	0·35
Dry Residuum	13·67 per 100		12·49 per 100	
Water	86·33 ,,		87·51 ,,	

Apart from race and individuality, there are many circumstances which have a marked influence on the quality of the milk. If the plant is the image of the soil, the cow is a subsequent product; therefore, the agriculturist ought rather to improve the local race by sensible feeding and judicious breeding than try to experiment with a race of cattle from outside his geographical area.

It must be borne in mind that the milk should be thoroughly drawn, because that which comes last from the udder is very much richer in butter than at the first; also the greatest care and cleanliness should be practised in the milking operation.

* Bulletin, Ministère de l'Agriculture, Paris, Quinzième année, No. 4. (Octr., 1896.)

† The illustrations are from drawings by M. J. Bonvalot, Professor at the Dairy School, Poligny (Jura).

‡ A litre is equal to 1·76 pints.

Of course the quality of the milk is of the greatest importance in the manufacture of dairy produce, but the best results do not entirely depend on that.

As soon as the milk comes into contact with the air, and rennet has been added, an active fermentation takes place, by means of numerous species of microbes, which have each a particular part in the decomposition of the organic matter contained therein.

These microbes remain in the curd which later on forms the cheese, and perform their work of decomposition with a favourable or unfavourable result, according as the state of the temperature, humidity, and the situation favours the evolution of one kind to the detriment of another.

A cheese-maker who ignores these facts is not up to his work, whatever professional qualifications he possesses; his results will be uncertain, often defective, and when failure takes place he will be incapable of discovering the cause.

During the last fifteen years, thanks to the admirable discoveries of Pasteur, and the researches of M. Duclaux, as well as to the remarkable works of other French and foreign scientists, and the stimulus given to scientific dairy-farming by the establishment of special schools, the cheese industry has undergone a perfect revolution in France. The methods of manufacture have been considerably modified, and the production of cheese, instead of being localised in its original place, has been extended with advantage, at the same time as the production of milk has increased considerably.

According to the report of M. Tisserand, and notwithstanding the increase in the annual production of milk, in 1893 France imported 12,632,897 kilos of cheese, and only exported 5,597,410 kilos, showing a difference of over 7,000,000 kilogrammes, representing in money value 10,809,693 francs.

This sum, which we pay annually to the foreigner, to make up the deficit of our national production, is a tribute which we could easily avoid by increasing the extent of our grazing land, and augmenting the number of our cows—by improving their breeds, and, above all, by improving the methods of manufacture, which are still very defective in certain districts, such as the Pyrénées and the Central Plateau, where the dairying industry is not considered of much importance, and is not progressing at all.

In all cheese-making the beginning is the coagulation of the milk by the addition of rennet; the subsequent different manipulations and fermentations to which the curd thus obtained is submitted, giving such and such a kind of cheese.

Manufacture of Camembert.

Camembert passes with good reason for the best and most delicate of soft cheeses. It was first made at the beginning of the century near Vimoutiers (Orne), in the commune of which it bears the name. Its manufacture afterwards extended rapidly in the neighbouring provinces and in certain other districts of France, but the Camembert most eagerly sought for by consumers and most appreciated in the Parisian markets comes in particular from Calvados.

The mode of manufacture which we shall describe is the one that is practised in several of the farms most renowned in Normandy for the good quality of their products. It has been applied with success, with a few modifications, to the Dairy School at Poligny.

The milk is purchased in the neighbouring districts, and should be delivered at the cheese-dairy by the vendors before 9 o'clock in the morning.

When the delivery of the two daily milkings is made only once a day, the morning milk should never be mixed with that drawn in the evening; indeed, only the former should be used for cheese-making, the other is made into butter.

If it is delivered twice a day, the evening's milk, on its arrival at the cheese-dairy, is poured into 20-litre cans, which are placed in cement basins, through which a stream of cold water constantly flows. The next day, after having tested this milk by the acidimeter, you taste it, and then it is mixed with the morning's milk before commencing operations. This latter proceeding is not to be recommended, although it is very often practised in winter, because whatever precautions may be taken, the quality of the milk has changed during the twelve hours it has remained in the dairy, and the product that is obtained from it will never possess the exquisite flavour of cheese made from fresh milk treated immediately after it has been drawn.

Above all, it is important only to use good wholesome milk. Whenever a case is doubtful it should be tested by the acidimeter and cream-tester. When the milk is brought in it is emptied into a receptacle surmounted by a sieve, which retains all sorts of impurities, which, in spite of all precautions, have fallen into the liquid. You have then a uniform mixture, which must be heated to a suitable temperature for ripening.

In the small cheese-dairies the milk is poured into tin cans of 50 to 100 litres capacity, and heated in a hot-water bath. In the large dairies where steam is indispensable for cleaning the different utensils and warming the rooms, there are multitubular milk-heaters capable of treating from 500 to 1,500 litres per hour.

The temperature of the heated mixture is indicated by a thermometer, and easily regulated by turning the feed-cocks of the steam or the milk. The season, the time, the temperature of the air, the degree of acidity of the milk, the richness in fat, the quality of the rennet are also circumstances which must be taken into consideration to determine the degree of heat which the milk should reach before ripening. Under any circumstances this operation is not successful except at a temperature between 26 and 31 degrees centigrade. The milk is heated so much the less when it is more acid, and for this reason it is wise to test it by the acidimeter before commencing operations. A milk which does not turn the testing-paper, which has no acid taste, and does not coagulate by the heat, can, however, be sufficiently acid to become detrimental to the making of good cheese, if, ignoring the acidity, you have not taken care to keep the temperature for ripening sufficiently low. There are two kinds of acidity—one called natural, and, which exists in the fresh milk; in ordinary milk between 16 and 20; in milk called alkaline it is below 16; in acid milks it is above 22; the other, which is called artificial acidity, is produced by the transformation of the sugar into lactic acid, and added to the first it rapidly reaches a stage which makes the milk bad.

The milk coagulates cold, as soon as the acidity exceeds 80; the same takes place in boiling when the acidimeter marks 27; whenever the acidity exceeds 20 degrees the temperature of ripening must be lowered 1, 2, or 3 degrees. The fatter the milk is the more it must be heated.

In winter it should be heated from 30 to 31, or sometimes to 29 degrees. In summer ordinarily to 28 or 29, and 26 or 27 during thunderstorms.

When a suitable temperature is reached a certain quantity of liquid is taken away, to which is added 0·4 per cent. of colouring matter; a spoonful of this solution is sufficient for 100 litres of milk.

Chapter I.

Properties and Action of Rennet.

The milk coagulates spontaneously under the action of a great number of substances, each having a special influence on the curd produced. The juice of certain plants, such as the "rennet," sorrel, artichoke, &c., will give their own flavour to the curd. The acids, and particularly lactic acid, which is nothing else but milk-sugar transformed by microbes, give a hard curd, disagreeable to the taste, and difficult to keep; only the curd obtained by the natural rennet is suitable for the making of cheese, and has no smell or taste. The natural rennet is a soluble ferment, secreted by the fourth stomach of young ruminants, under a milk diet.

Formerly each cheese-maker prepared his rennet by macerating calf's rennet in certain liquids, by more or less empirical processes, but the rennets thus obtained were generally thick, contained foreign matters, and often ferments detrimental to the cheese. As their strength varied greatly it was difficult to obtain a uniform product. In order to ensure a product of uniform quality it is absolutely indispensable to have a perfect rennet with a known and unalterable coagulating strength. The extracts of rennet, which can be bought, fulfil these conditions, but care must be taken to keep the bottles in the dark and well corked. Light rapidly diminishes its strength. There are several kinds, for instance—

Liquid rennet, of which 1 litre will coagulate	2,500 litres of milk.
	10,000 "
	100,000 "

Milk heated to 35 degrees centigrade, with a certain quantity of rennet added, becomes in a few minutes a white elastic mass, having the consistency of jelly. If the curd thus formed is left alone it contracts to a third or a quarter of its original volume, the whey escaping and floating on the surface. The action of the rennet which causes this coagulation is not due to the formation of an acid, since coagulation takes place, although more slowly, in an alkaline solution; that which acts is a nitrogen soluble ferment, as we have described before.

It is highly important to know what are the elements of the milk which remain in the curd, and what those are which pass into the serum. M. Duclaux has, from the first, studied this question, and he has given the following analytical results in his work on milk:—

—	Elements.			
	Solids.		Liquids.	
	Milk.	Serum.	Milk.	Serum.
	gr.	gr.	gr.	gr.
Fatty matter	4·30	0·85	0	0
Milk-sugar	0	0	5·37	5·77
Casein	3·53	0·46	0·37	0·36
Phosphate of lime	0·23	0	0·17	0·17
Soluble salts	0	0	0·40	0·43
Total...	8·06	1·31	6·31	6·73

These figures show us that the solids in the milk—fat, casein, phosphate of lime—almost entirely remain in the coagulum, whilst the liquids are all found in the serum (or thin part of the milk).

The quantity of fatty matter which remains in the latter depends on the manner in which the milk is worked and the way it is shaken. If it is worked quickly, or if the curd works up very soft, a part of the fatty matter passes into the serum; if the curd is very firm, on the contrary it preserves nearly all this matter.

The milk-sugar is concentrated more in the curd than in the serum, which contains, beside the soluble casein, colloidal casein, and the soluble phosphate of lime.

In acid milks the proportion of soluble phosphate of lime is greater than in ordinary milk, because the acid dissolves part of the phosphate of lime originally insoluble.

So, as we have said, the richness of the milk in fatty matter, its temperature, its acidity, the different salts it contains are so many factors affecting its coagulation by rennet.

The quality of the milk is never quite the same in two milkings separated by an interval of twenty-four hours, and if you do not take into consideration the nature of the milk on one hand, its temperature, the quantity of rennet, and the time of coagulation on the other, you must expect great differences in the quality of the product.

Action of Salts, Bases, and Acids on Rennet.

Certain salts have the property of coagulating milk without the co-operation of rennet, such as sulphate of magnesia, chloride of calcium, phosphate of soda, salts of baryta, strontia, &c. Generally, these salts, in small quantities, accelerate coagulation, whilst in the contrary case, large ones retard it. Alkaline salts, carbonate of potash, carbonate of soda, borax, &c., also retard the action; by adding 1,000th part of carbonate, coagulation takes place ten times more slowly.

It is the same with the bases. If 1,000th part of lime is added, it takes four times as long for the curd to form. As for the acids, they cause the milk to coagulate all the quicker when the temperature is high. Boracic acid alone is sometimes added to retard the formation of the lactic ferments, which are the cause of the natural coagulation of the milk. Borax, or borate of soda, is often employed for the same purpose.

According as the lactic ferments transform the sugar into lactic acid, this latter re-acts on the borax and forms a neutral salt (lactate of soda), whilst the boracic acid, set at liberty, acts as an antiseptic.

Rennet.

When a rennet is sold, of 10,000 strength, it means that 1 cubic centimetre of this rennet coagulates 10,000 cubic centimetres of milk, heated to 35 degrees, in a specified time. That is to say, the strength of a rennet is proportioned by the quantity of milk it coagulates, and experience shows that this strength is in inverse proportion to the time it takes to coagulate the same quantity of milk; so that if 1 cubic centimetre coagulates 10,000 cubic centimetres of milk, at 35 degrees, in 40 minutes, ½ cubic centimetre will only coagulate 5,000 cubic centimetres, other circumstances being equal.

If a given quantity of milk is coagulated by a certain quantity of rennet in 30 minutes, the same quantity of milk would be coagulated in 15 minutes,

if one doubled the dose of rennet. This is only the rule when the quantities of rennet employed are neither too great nor too weak, and when the temperature of the milk that is to be coagulated remains between 18 degrees and 40 degrees centigrade. A too large dose of rennet makes the liquid thick, but does not coagulate it properly. When the dose is too weak, coagulation is interminable. It coagulates best at 37 degrees, above or below that temperature its action gradually diminishes, while at 55 degrees and at 15 degrees it is not possible.

A good cheese-maker ought not only to know this, but to understand as well the strength of the rennet he uses, and to be capable of putting it to the proof daily. With this object the following process is very simple, and gives sufficiently correct results :—

Pour 10 cubic centimetres of rennet into a vessel and fill it up to 100 cubic centimetres with distilled water. Ten cubic centimetres of this mixture corresponds to 1 cubic centimetre of the regulation rennet.

For example, heat 1 litre of milk to 30 degrees, add 10 cubic centimetres of the solution, and let it stand. To ascertain when the coagulum is formed, bury a knife-blade in the milk, and the imprint left should be clearly marked, and should fill with a greenish liquid. The time required from beginning to end of the operation should be 4 minutes.

Now, to find the coagulating strength, that is to say, how many cubic centimetres of milk, heated to 35 degrees, will be coagulated by 1 cubic centimetre of this rennet in 40 minutes.

Here we have the rule of three :—

$$
\text{1 cubic centimetre rennet coagulates.}
\begin{cases}
\text{In 5 minutes, at 30 degrees, 1 litre of milk, or 1,000 cubic centimetres.} \\
\text{In 1 minute, at 30 degrees, } \frac{1}{5} \text{ litre.} \\
\text{In 35 minutes, at 30 degrees, } \dfrac{1 \times 35}{5} \\
\text{In 35 minutes, at 1 degree, } \dfrac{1 \times 35}{5 \times 30} \\
\text{In 35 minutes, at 40 degrees, } \dfrac{1 \times 35 \times 40}{5 \times 30} = 9\tfrac{1}{3} \text{ litres, or 9,333 cubic centimetres.}
\end{cases}
$$

Under these conditions of time and temperature, the coagulating strength sought would be 9333. If we wish to know the quantity of rennet required to coagulate 100 litres of milk heated to 30 degrees, in two hours, the strength of the rennet being 2,500, we reckon thus :—

If 1 cubic centimetre coagulates 2,500 cubic centimetres of milk at 35 degrees in 40 minutes how much will coagulate 100,000 cubic centimetres at 30 degrees in 120 minutes? We have $\frac{100,000 \times 40 \times 35}{2,500 \times 120 \times 30} = 15{\cdot}55$, or say 16 c. centimetres.

CHAPTER II.

Ripening.

GENERALLY, we reckon that to make 100 camemberts, it takes nearly 190 to 196 litres of milk in winter, and very nearly 210 in summer, which makes 1·9 or 2·1 litres per cheese according to the season of the year. Milk in summer is more aqueous, and much more acid; it gives a closer curd and that is why it is necessary, when one desires to make cheeses during this season, of the the same weight as in winter, to use a little more milk in their manufacture. Close upon two hours is the best time to allow for coagulation when making camemberts.

In many dairies the whole of the milk is ripened in one lot, and then the dressing is proceeded with.

This however is a bad plan, because supposing that you make 1,000 cheeses per day, the necessary 2,000 litres of milk are ripened two hours before putting into the mould, and consequently ready to be operated upon at the end of that time. Now, to obtain a soft cheese like the one we treat of, of good quality, the curd must be soft, watery, and little adhesive, which is the result of slow coagulation, with a small quantity of rennet.

The working of a certain quantity of curd takes a certain time, during which coagulation goes on increasing, if you exceed the regular time even a little, the coagulum becomes hard and contracts, and the cheese will never have a fine and soft grain; and its flavour will be unpleasant.

To avoid this inconvenience the ripening is generally divided, a maximum of 100 litres being coagulated at a time. If the curd is watery and too soft, the drainage is slow, particularly in winter and to hasten it, the dairy must be heated. However the heat need not be great, or the cheese becomes dry, and warped, and is covered with a sticky coating which prevents it from taking the salt properly; and afterwards this circumstance is detrimental to the cryptogamic growths which cause it to mature.

It is a bad practice to put all the curd in the mould at the same time, it hinders the drainage, and gives the cheese a poor quality. The curd which is placed first in the mould, and which will later on form the crust of the cheese, should be a little harder than the remainder in order to make it easy to turn, and it will be all the better if it adheres a little to the stand.

To ensure this condition, the stand should be carefully washed with hot water first. In our opinion the milk should be ripened in six lots, and the moulding or dressing done in five hours.

The sixth part of the whole quantity is poured into tin pails, of a certain size. These receptacles are carried into the dressing room, and at the exact time when the milk which they contain is coagulated, a spoonful of curd is placed in each mould.

One hour after, a second spoonful of curd taken from the second sixth is placed upon the first, and so on, six spoonfuls of coagulum being necessary for one cheese, and each spoonful (or ladleful) being placed in the moulds at an interval of an hour.

The lower the outside temperature, the more must the milk be heated before mixing with the rennet.

In winter, the first sixth is mixed at 31 degrees, when it is very cold, and at 30 degrees in ordinary times; it must never descend below this temperature, except in summer when it only requires heating to 29 degrees. A second, third, and fourth, sixth, as they are mixed one, two, and three hours after the first, should be heated to 29 degrees in winter, and 27 in summer; finally the last sixth should reach 28 degrees in winter, and 26 to 27 in summer.

These figures are not absolute, they vary according to the district, and the nature of the milk, but an intelligent cheese-maker who feels his way carefully, will soon find out the temperatures which are most suitable for his work in any particular locality.

For reasons already indicated, the temperature of the milk used in the first part of the work should be raised a little. In the second phase of the operation, and particularly at the end, the degrees of heat diminish both in summer and winter, because it is indispensable that the last spoonfuls of coagulum deposited in the moulds should be formed of a soft and watery curd, in order to prevent the cheese from becoming too dry on the surface whilst it drains. We shall see presently that to arrive at this result, not

only must the temperature be reduced, but also the dose of rennet. Finally, the differences between the temperatures of winter and summer, in order to make the coagulations correspond, are due to the coolness which is produced during the formation of the curd, and which is more marked in summer than in winter, and also to the fact that during the latter season milk acidifies less quickly than in summer.

Concerning the quantity of rennet to be used, account must be kept of the rules and particular circumstances that we have already indicated; it is for the cheese-maker to determine the dose necessary to produce the desired degree of coagulation. Camembert is a cheese which matures quickly and regularly; the curd should be obtained with very little rennet, otherwise it will be hard and brittle, especially in summer, when the milk easily coagulates.

In Calvados, during this season, a liquid rennet of a strength of 2,500 is generally employed. In winter they use a rennet of 10,000, which is mixed with equal parts of water, in ordinary weather; whilst during the coldest weather the mixture should be formed of two-thirds rennet and one-third water.

In the following tables, which show the temperatures mentioned above, and the doses of rennet to be used, we are supposed to have to transform 600 litres of milk into Camembert; the quantity of liquid treated is divided into six equal parts, which are mixed at intervals of one hour:—

1. Summer Manufacture.

Test.	Quantities of Milk.	Temperature of Heat.	Quantity of Rennet (Strength, 2,500).
	Litres.	Deg. centigrade.	Grammes.
1	100	29	17
2	100	28½	17
3	100	28	15
4	100	28	14
5	100	27½	14
6	100	26-27	13-12

2. Winter Manufacture.

Test.	Quantities of Milk.	Temperature of Heat.	Quantity of Rennet (Strength, 10,000).	
			½	⅔
	Litres.	Deg. centigrade.	Grammes.	Grammes.
1	100	30-31	18	15
2	100	29-30	17½	15
3	100	29-30	17	15
4	100	29	17	15
5	100	29	17-16½	14½
6	100	28	16	14

In the small dairies, where the daily quantity of milk is insufficient to be coagulated in six lots, the number may be reduced to two, three, or four; but then two ladlefuls of the curd must be placed in the mould at a time; two hours after two or three more may be placed in it, and at the end of three hours the last may be deposited, always taking care that this curd is more watery and less coherent than the preceding ones.

Chapter III.

Dressing or Moulding.

The coagulation is complete when on pressing the curd, only a few drops of colourless liquid cling to the fingers, free from small white granules.

The moulds (fig. 1) are deposited alongside each other on tables (fig. 2) covered with wicker stands or trays of fir. They are made of tin, and their sides are pierced with holes placed in screw form, and their dimensions are 4½ to 5 inches diameter, 4 to 4½ inches high for Camembert.

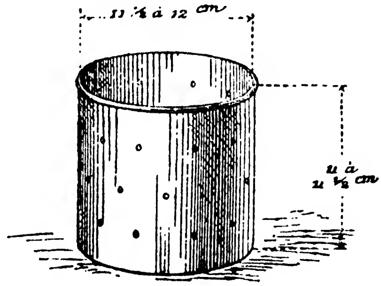


Fig. 1.

The wicker stands or trays are the same width as the gutter (or drain), and about 40 to 60 inches long. They should be changed every day, and before being placed on the tables they must be carefully rinsed in boiling water.

Before commencing to fill the moulds, first, by means of a perforated spoon (figs. 3 and 4), remove the cream which has risen to the surface of the curd during its formation. This operation is of great importance, as, if the cream is left, the cheese has a tendency to become rancid, and will not be of uniform quality and appearance. After this has been done, commence to dress or form it by means of a spoon (fig. 5), which is put in the curd with great care so as not to break it. Each full spoon is deposited in the mould, care being taken not to break the curd or turn it over, otherwise the different layers will not stick

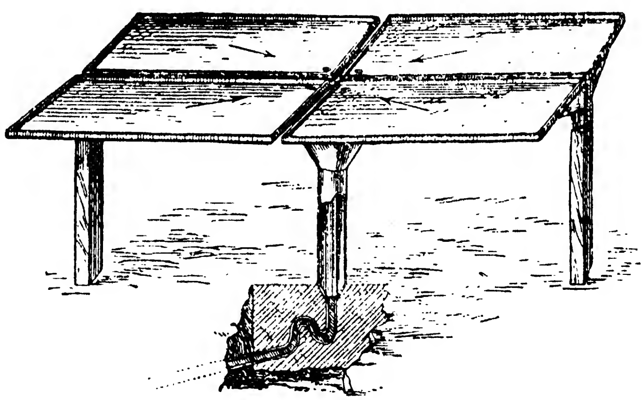


Fig. 2.

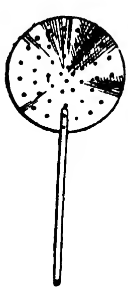


Fig. 3.

Fig. 4.

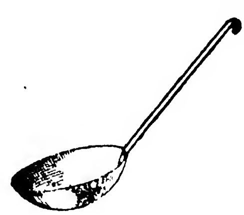


Fig. 5.

together; in fact, experience shows that if a spoonful is turned over in the mould, and others deposited on the top of it, the layers will not adhere, and the cheese divides into several horizontal strata.

Often the mould is quite filled by four spoonfuls of curd, but after an hour the cheese is generally sufficiently drained to admit a fifth spoonful. The same thing is done with the sixth. In warm weather the curd sinks very quickly, and it is not necessary to wait an hour between each spoonful. In winter, the drainage is much slower. You can of course hasten it by heating the room, but this has a bad effect, and it is better to wait a little longer before putting the last spoonfuls of curd in the mould.

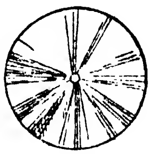


Fig. 6.—Plate.

The temperature of the draining room should never be above 18 degrees; in winter it should be kept at 17. In summer if it gets too high it must be lowered to the right degree by currents of air from openings made in the wall for this purpose. When the moulding or dressing is finished, and the curd has sunk from $\frac{3}{4}$ to $1\frac{1}{4}$ inches, each mould is covered by a round tin plate (fig. 6) made with a hole in the middle. With this plate the cheese is sheltered from the action of the air and heat, it drains without drying too much, and the surface remains even instead of becoming concave as is usually the case.

Chapter IV.

Turning—Paring—Salting.

Beginning about 10 in the morning the dressing is finished about 3 o'clock in summer and 5 in winter. The cheeses drain all night, and the next morning their consistency is firm enough to allow of their being turned. To effect this, a disc of indiarubber (fig. A) is applied to them, and they are raised in the same way that children draw up stones with their stone-suckers, then the right hand is passed under the bottom which rests on the stand, with the left hand on the top of the mould, and you turn the whole adroitly on to the stand. When this operation is over, make sure the cheese has been properly placed in the form; press lightly with the hand to make it lie firmly on the stand; cover it again with a plate, and it continues to drain until the next day. The curd sinks together during the draining, but it settles more in the middle than at the sides, to which fragments of curd sometimes remain stuck.

Fig. A.—India-rubber disc.

The plates should, however, prevent this inconvenience, but it sometimes happens that these stick in the middle of the form, in that case the edges of the cheese are a little higher than the centre, and it is necessary when they are withdrawn from the moulds to pare them with a knife to give them an equal surface.

The cheeses are afterwards deposited on stands placed above the drains, there they remain for some hours to dry a little, then they are salted all round and on the top. The salt used should be very dry and fine. It should be distributed lightly and very evenly. The object of the salting is to dry

the curd, and to remove the excess of whey it still contains. In the places where there is no salt the mould will not develop, the cheese reddens, becomes sticky, and its quality deteriorates.

If it is too heavily salted the moulds develop too much, their mycelium forms a hard and very thick crust around the cheese, the paste becomes dry and brittle under the teeth, and it is said to be spiced.

Chapter V.

Drying and Finishing.

Drying-room.—After salting, the cheeses are removed to the drying-room and placed $\frac{3}{4}$ to $1\frac{1}{4}$ inches apart on shelves.

Each shelf is formed of separated ribs, and constitutes a sort of movable rack between two grooves, so that it may be drawn forward during the turning of the cheeses. The shelves are covered with rye straw, upon which the cheeses are arranged; but it is preferable to use a tray (fig. 7), as then the

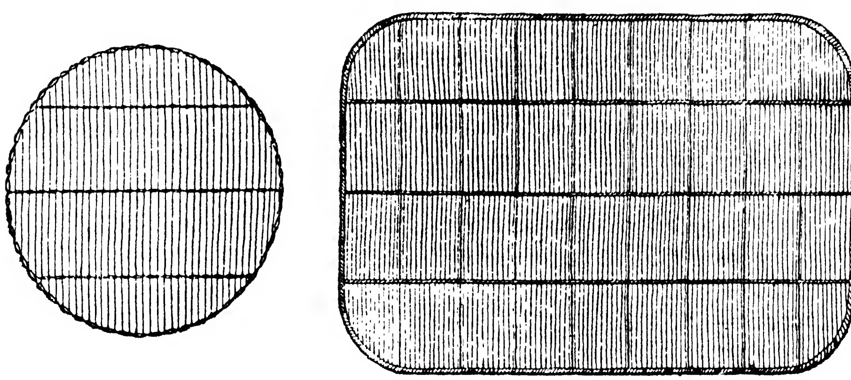


Fig. 7.

work can be done better and more quickly. The ribs should be sufficiently apart to allow the air to circulate all over the surface of the cheese, so as to dry it enough.

The drying-room is best situated on the first floor, above the cheese-making room, and the walls should be thick enough to maintain in it an even temperature, by which means the expense of double walls is avoided. In order that the development of the mould in the drying-room may take place under favourable conditions, the temperature should remain near 12 degrees. When it freezes in winter the room is sometimes warmed with a coal-fire, but care must be taken that the heat does not become too intense. Cold does no harm to the cheeses, unless they are badly drained, so that the question of time only need be considered. Camembert, instead of remaining in the drying-room eight to ten days, as in summer, may remain there twenty to thirty days in winter, and sometimes more if the cold is excessive, and the quality will not suffer; they always reach the degree of maturity necessary before their removal to the cellars, and at that time they ought again to be a little damp. The drying-room should be very dry and airy. When it is newly built the cheeses in it often become blue, or sometimes green. That shows

a dampness which may easily be rectified by spreading a layer of straw or sawdust on the floor, or even by placing there dishes of quick-lime. In the same manner the dampness caused by fog may be avoided. When warm moist winds prevail for a length of time, the cheese, instead of becoming firmer, softens and begins to run, if the humidity is not carefully regulated by means which we will describe. If, on the contrary, the atmosphere is hot and dry, it is necessary, to prevent the cheese from becoming hard, to air the drying-room and moisten it with water, if that should be necessary.

The drying-room should be constructed in a very light place, where the air circulates freely at all times, and the draught may be increased or lessened at will. To regulate the light and the currents of air, the walls have openings (fig. 8) furnished with glass panes and wooden shutters, and between them is a close wire netting to keep out the flies.

The wind dries the cheeses very quickly, while the direct rays of the sun spoil them completely; therefore, every time the windows are opened, unless the weather is very calm, it is necessary to draw down the blinds, so as to preserve the cheese from sun and wind.

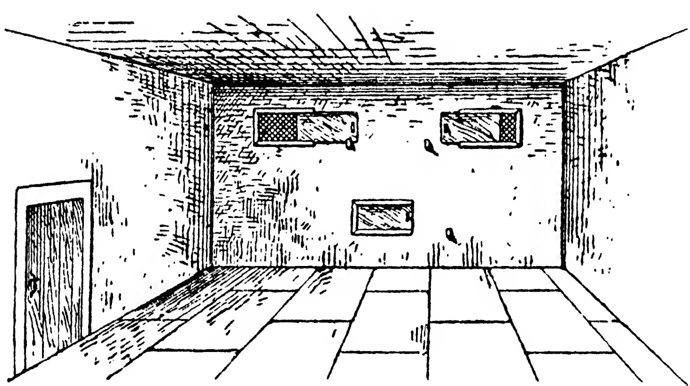


Fig. 8.

When the weather is foggy, windy, or stormy all the ventilators should be closed. This precaution must always be taken at night, for at day-break, even in fine weather, there is always a fine mist which has a bad effect on the cheese; otherwise, when the weather is fine and calm, air the drying-room as much as possible.

The way the cheese is drained, the temperature of the drying-room, and its hygrometric condition, have a great influence on the working of the microbes, which cause the cheese to mature. The most favourable temperature is from 10 to 12 degrees. Below that the development of the *mucedinees* stops. The mould, in destroying the lactic acid in the curd, takes away part of its moisture, and if the hydrometric condition of the drying-room is lower than 90 degrees, the dessication of the cheese will go too far, the paste will become dry and hard, and its quality will deteriorate. If the heat and moisture are too great, fermentation becomes too active, the ferment of the casein causing the outside paste to run before the mould has destroyed the acidity of the internal mass. When all the conditions are favourable, after three or four days in the drying-room, the mould begins to appear on the cheese, and from eight to ten days in summer, from twenty-five

to thirty days in winter, they are covered with a beautiful cryptogamic vegetation, at first white, then bluish, the operation of which we will study later on. If all goes well, the cheeses need only be turned once in the drying-room, when their tops are covered with mould. To judge of the progress of the fermentation, taste the cheese, so as to discover if it is soft enough to be placed in the cellar.

Cellars.

The cheese, when removed to the cellar, is placed according to age on the shelves (fig. 9). In the drying-room the *mucedinees* have finished their work, that of the ferments of the casein now begins. If the cheese is cut as soon as it is taken from the drying-room, it will be seen that its interior has

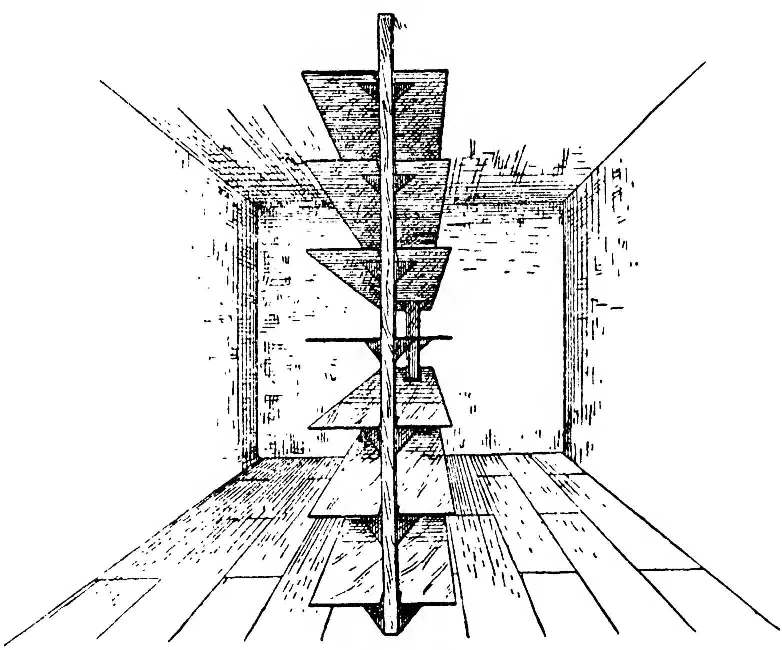


Fig. 9.

undergone no apparent modification. The acidity alone has disappeared, but the paste remains quite white. During its stay in the cellar, it takes a yellow colour, softens more and more, and begins to run if it is not consumed when it is ready.

We will refer again to this subject, when we will study the part taken by the microbes in this transformation. Here, as in all fermentation, temperature and moisture have a great influence. The best temperature for the cellar is from 12 to 14 degrees; below that the ripening is retarded; above it, the more water the paste contains, and the more abundant the *caseone*, produced by the ferment of the casein, the more rapidly it softens and runs; therefore it is necessary for the cellar to maintain a hygrometric condition of 80 degrees, or a little lower than that of the drying-room.

The length of time the cheese must remain in the cellar varies with the season. From 15th May to 15th October it should stay there about ten days, at the end of which time it is despatched to the consumer before it is quite fully ripe, or during the journey it may run. In winter the situation is more favourable. The cheeses are finished in fifteen or twenty days, and are sent to the market thus, because during this season the outside temperature does not hasten their fermentation.

In winter the cellar may be heated like the drying-room—that is, with a coal fire, but generally it is warm enough. The number of times the cheese requires turning in the cellar varys very much; it is a matter which the cheesemaker ought to know best himself. Whenever the cheeses soften, it is indispensable to remove them to the bottom shelves, the top ones, where the temperature is higher, being reserved for the firmest cheeses. By thus changing their places, they ripen with more regularity.

The cellar should be rather dark, and only aired enough to carry off the excess of dampness.

The openings in the walls for ventilation should be placed one above another, so that the fresh air comes in at the lower ones and escapes through the upper. The more openings there are the better the air is distributed, and the less likely the cheese is to take any harm from it.

Never air the cellar by opening the door and windows; the current of air would be too great, and would quickly dry up all the cheeses.

The shelves should be well washed and dried in the sun before being used a second time.

Finally the ventilators should be provided with very fine metallic nets. Like those of the drying-room, the windows are furnished with sliding shutters, so as to keep the cellar in semi-darkness, and keep out the sun's rays.

Chapter VI.

Microbes.

When a ray of light penetrates through a crack in the shutter into a dark room one notices how the specks of dust move about in it continuously.

A large proportion of these specks which circulate in the air in great numbers are living things capable of nourishing themselves, of reproduction, and of secreting various matters like superior animals. These creatures are so infinitesimal that in order to examine them by the microscope it is necessary to magnify them from 500 to 800 times. In spite of their smallness we are enabled, thanks to the admirable discoveries of Pasteur, to study and understand their modes of existence. These creatures, which are generally known as microbes, are formed like cells, sometimes singly, sometimes joined together.

They are capable of changing weights of food matter considerably greater than their own several hundred times a day, and they reproduce themselves with such rapidity that one litre of milk, which contains nine millions one hour after milking, contains nearly six milliards and a half at the end of twenty-four hours, unless care has been taken to cool the milk below 12 degrees as soon as it is drawn from the cow.

These micro-organisms have been divided, according to their form and general properties, into *bacteria*, *yeast-like ferment*, and *mould*. *Bacteria*, as will be seen further on, have, with the mould, an important part to play in the ripening of cheeses. Sometimes they are of a rounded form and are known

as *coccus* or *micro-coccus*; sometimes they are elongated and bear the name of bacilli. In order to multiply itself, the small sphere becomes elliptical, and extends into the form of the figure 8, which parts in the middle, when there are two *coccus*, which, in their turn, can multiply in the same manner, producing chains more or less long and symmetrical. The bacilli have the shape of small cylinders, rounded at the end, sometimes straight, sometimes spiral.

When reproducing, the bacilli lengthens, closes together in the middle, and finishes by dividing into two cylinders which sometimes hold together.

Another manner of reproduction is the formation of *spores*. On one of the ends of the bacillus is seen a rounded matter more refracting, the brightness of which increases by degrees, when the coat of the microbe throws it off, and it becomes capable of giving birth to another bacillus.

Yeast microbes for ferments.

These are infinitely small, and play a very important part in the fermenting of wine, beer, bread, &c. They have an oval shape (fig. 10), and are generally larger than the bacteria.

When they multiply, a small pimple is formed on the surface, which grows slightly, and detaches itself (or may remain united to the mother globule) when it has attained the right dimensions.

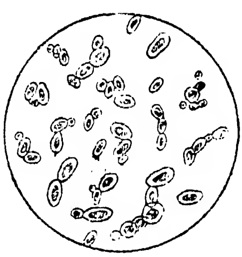


Fig 10.—Levures.

The yeast can be reproduced by means of spores like the bacilli, but the latter has only one, while the yeast on the contrary can produce two, three, or four.

Mould or must can be classed amongst the microbes as it has a certain analogy to them.

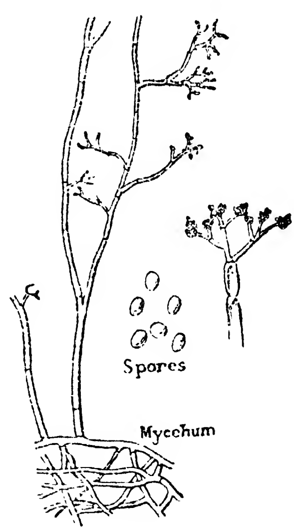


Fig 11.

It is characterised by a mycelium (fig. 11) formed of tubular cylindrical branches entangled in each other and forming a sort of very thick felted matter in the liquid which nourishes them.

Each element of this mycelium transferred to a similar liquid will reproduce and develop an exactly similar system to that from which it was taken.

It can also be reproduced and multiplied by means of spores (fig. 11) which develope on the exterior of the mycelium, contrary to those we have seen produced in the interior of the ferment of bacilli and yeast. A small branch will rise from the mycelium to a certain height and form a kind of tree carrying fruit like small globules, the colour and the shape of which vary, and which are nothing but spores, capable of reproducing a new mycelium with fruit-bearing branches, when they fall in a suitable medium.

In all ferments, the spore is the form of resistance of continuance of the species. It can be carried in the air, and dried and preserved for a long time without altering its germinating property.

Influence of physical and chemical agents on ferments.

The action of ferments in connection with physical and chemical agents varies according to the composition of their cellules. Each species has a life of its own, but all their modes of existence have common characteristics which it is indispensable to know in order to understand what is mentioned further on.

No. 1. *Action of heat.*—Temperature plays a very important part in the vital process of microbes, and each species requires a certain degree of heat to attain its maximum of activity. Generally, this degree is not lower than 15 degrees centigrade and not higher than 60 degrees. When these limits are exceeded, the working of the ferment becomes less energetic. As the temperature rises, the microbe becomes weaker and weaker and succumbs as soon as its power of resistance to heat is exceeded. This point is generally under 100 degrees for ordinary microbes, but for spores it can exceed 125 degrees if it is not for very long. Such for instance is the case of *Penicillium glaucum*, which is sown in the form of mouldy cakes in the Roquefort cheese, and which is again found in the first stage of the ripening of soft cheese.

Cold suspends the working of ferments, but does not kill them like heat. It first stops the growth of the spores, reducing them as it increases in intensity, and finally paralyses them completely. The microbes remain latent, and fall into a sort of lethargy, not reviving until the temperature again becomes favourable. The *Penicillium glaucum* is one of the least sensitive to cold, and grows even as low as 5 degrees centigrade.

The preservation of articles of food by chilling, pasteurisation, and sterilisation is a happy application of the property of heat in connection with ferments.

No. 2. *Action of Light.*—Some varieties of microbes, principally mould, shun the sunlight. It rapidly diminishes their power, and often kills them in a few hours, which is the reason why among the dust floating in the air there is a large number of dead germs and very few living ones.

No. 3. *Action of Oxygen.*—Certain ferments cannot live without oxygen, others develop in mediums which do not contain it. The first are called *aerobies*, and the latter *anaerobies*. Some live either with or without oxygen, that is to say, are both *aerobies* and *anaerobies*.

No. 4. *Influence of the medium of Nutrition.*—To live, develop, and multiply, microbes require food, which they find in the carbon and azotic matters. Certain chemicals at times favour one species, and are detrimental to another; thus acid liquids are favourable to moulds, and alkaline mediums suit bacteria better.

No. 5. *Microbes in Milk.*—Though the milk is free from microbes when drawn from a healthy cow, it is an organic medium containing all the materials necessary for feeding ferments. Hence it is not surprising that it becomes contaminated at milking, and during the following manipulations,—the more rapidly when perfect cleanliness is not observed. The modifications which take place in it are as numerous as the different species which can live in it.

There are to be found, besides mould, ferments of sugar and casein, certain yeasts, which transform the lactose into alcohol, as shown by M. Duclaux, Kayser, and Adametz. Often there may be found bacteria, which alter the colour, taste, and quality, serving as vehicles which transmit to the consumer germs of contagious diseases such as typhoid fever, tuberculosis, &c.

The works given below (*), which treat on these, give complete details of all these species, but in this article we only take notice of those which take an active part in the ripening of soft cheese; which are—lactic ferments, moulds, and casein ferments.

Chapter VII.

Ripening of Soft Cheese.

Milk, when rennet is added, is heated to a temperature very favourable to the development of microbes, which it always contains whatever precautions have been taken to avoid it.

During the two hours the coagulation lasts these microbes multiply rapidly, and begin to disorganise the medium in which they live. The lactic ferments appear first; their number is very large, but they do not all act in the same way. Mr. Kayser has shown that the intensity of their work varies for each species according to age, degree of heat, presence or absence of oxygen, the depth of the vessels where coagulation and drainage takes place, the presence of lactose, and directly assimilating albuminoidal matter, and the acid or neutral action of the milk in which they work.

After the rennet is added, and during the hours the cheeses are in the moulds, the lactose is transformed into lactic, carbonic, and acetic acids, the latter in very small quantity.

Each species produces at the same time different quantities of lactic acid, many of those which are found in dairies making the milk very sour, afterwards destroying a portion of the acidity they have produced. But you find also some which do not cease to increase the acidity until the whole of the existing lactose is completely destroyed. These results are generally obtained at the end of the draining, when the cheese is taken from the mould to be pared and salted.

At this moment the work of the lactic ferments is finished. They have considerably changed the curd in which they live, but are incapable of forcing any more decomposition. It now remains to make the albuminoidal matter more soluble and digestible. The ferments of casein only can accomplish this change; but for this purpose is required a medium only slightly moist, neutral, or alkaline, and when the curd is acid they remain inactive. To destroy this acidity we have resort to mould, which we know lives by preference in acid and humid mediums. The germs of this mould exist in the air of the dairy, and in the utensils used. One of the most common species is the *Penicillium glaucum* before spoken of as resisting cold and heat. Now appear small white spots on the cheese, which gradually spread, and finally cover its whole surface if the salting is uniform. Soon this white velvety felt becomes bluish and branches of spores rise, the myceline trunks penetrating the paste, destroying its excess of moisture and lactic acid, and changing the albuminoidal matter of which the crust of the cheese consists into oxalic acid, leucine, tyrosine, and carbonate of ammonia. The acidity should have disappeared before the spores are formed, because from that moment the mould rapidly dries up the cheese by actively absorbing all the moisture it contained. When the cake of curd has become neutral, the mould has finished its work, and the casein ferments begin theirs. These bacteria secrete a rennet which coagulates the milk; but, unlike the lactic ferments, they can again dissolve the curd which they have formed by aid

(*) Duclaux, Microbiology—De Freudenrich; Microbes in Milk—Macé, Treatise on Bacteriology.

of another substance which they produce—*casease*—and by this means change the casein into a much more digestible matter. which M. Duclaux calls *caseone.*

Like the lactic ferments, they are both aerobies and anaerobies. The aerobies take the necessary oxygen from the surrounding air ; the anaerobies, on the other hand, avoid this oxygen and secrete much less casease, but create matter much more odorous and tasty. These are the agents of putrefaction, and their secretions produce occasionally turgid swellings, or puffinesses, found in cheese of bad quality.

We will now rapidly examine the numerous products of these species, beginning with aerobies.

As the mould destroys the acidity of the curd, reddish spots develop and extend over the cheese, finally covering the whole surface. This shiny and sticky redness is formed by casein bacteria. The aerobies begin their work first helping each other to absorb the oxygen in the interior of the curd, thus favouring the other ferments and anaerobies which act afterwards. In the course of the fermentation, which extends from the outside inward, the properties of the casein are greatly changed. In the centre of the cheese it forms a solid mass, distinguished by its white colour from the soft, yellow, and oily paste which surrounds it. The caseone is produced in more or less abundance as the bacteria secrete casease, and when the white colour has completely disappeared, the ripening of the cheese is finished, all the casein is changed into a more digestible matter, the decomposition has only commenced, the anaerobies have barely started, and the tasty and odorous matter which they give off is not yet abundant enough to give a bad taste to the cheese. Now the product is finished, and is at the point of perfection, and the quality deteriorates rapidly if the decomposition of the albuminoidal matter continues. M. Duclaux says:—"For all cheeses there is a certain period of ripening, more or less long, after which deterioration sets in by the exaggerated action of the phenomena which have produced the ripening."

Therefore, whilst the aerobies liquify the caseone and cause the paste of the cheese to run, the anaerobies produce a putrid fermentation, giving off gas, which escapes from the exterior in the form of sulphate and phosphate of hydrogen, decomposing the whole mass, and thus facilitating the work of the ferments, which, up to that point, have been inactive, but which now force the casein to its last change, into carbonate of ammonia.

To sum up, the mineral matter in the cheese is the only one remaining intact. The organic matter, after having changed to a kind of digestible peptone, is decomposed into diverse products, such as leucine, tyrosine, and salts of ammonia, in the composition of which enter acetic, valerianic, and butyric acids, products which in their turn decompose into carbonate of ammonia and free ammonia, which escapes in the air. Below are the results obtained by analysing two Camembert cheeses by Duclaux's method:—

Sample 1 was a cheese taken three days from the mould, salted the day before, and not yet showing any mould on the surface.

Sample 2 was a perfectly ripe cheese, and of first-class quality.

No. 1.

Water			60·75	
Fatty matter		19·33		
Casein and organic matters (16·10)	Non-solubles	13·23		21·42
	Solubles	2·87		
Mineral matters (3·82)	Non-solubles	0·77		3·33
	Solubles	3·05		
Dry extract			39·25	
Total			100·00	

No. 2.

		50·20
	25·05	
Non-solubles	18·02	
Solubles	3·40	
Non-solubles	0·25	
Solubles	3·08	
Dry extract	...	49·80
Total	...	100·00

These results confirm, for the Camembert, what M. Duclaux has said with regard to the quantities of fatty matter and mineral salts contained in the Brie cheese; in fact, we see in both cases the fatty matter is half of the total dry extract, and the greater part of the mineral matter is found in a soluble state.

Coagulation of Three Lots of Milk.

Dates.	Total quantity of Milk.	Description of Milk.	1. Quantity.	1. Temperature.	1. Acidity.	1. Quantity of Rennet used.	1. Length of Time.	1. Quality of Curd.	2. Quantity.	2. Temperature.	2. Acidity.	2. Quantity of Rennet used.	2. Length of Time.	2. Quality of Curd.	3. Quantity.	3. Temperature.	3. Acidity.	3. Quantity of Rennet used.	3. Length of Time.	3. Quality of Curd.
	lit.		lit.	deg		cc.	h.m.		lit.	deg.		cc.	h.m.		lit.	deg.		cc.	h m.	
15 Nov. ..	180	Fresh	60	30	18	8·7	2·25	G	60	29	19	8·0	2·20	G	60	29	20	8·4	2·05	G
19 Nov. .	60	Fresh	20	30	21	2·7	2·10	G	20	30	20	2·8	2·06	G	20	29	20	2·7	2·10	G
23 Nov. ..	120	Fresh	40	30	19	6·0	2·05	G	40	29	20	5·8	2·15	G	40	29·5	20	5·6	2·25	G

Table Relating to the Manufacture of Camembert and Brie.

	Temperature of Cheese-making Room.	Number of Cheeses.	Drainage at the time of Salting.	Date when placed in Drying Room.	Temperature of Drying Room.	Hygrometric Condition of Drying Room.	Appearance on leaving Drying Room.	Date when placed in Cellar.	Temperature of Cellar.	Hygrometric Condition of Cellar.	Time in Cellar.	Total time in making.	Result of making.	Average Price per Cheese.
	deg.				deg.				deg.		d'ys	d'ys		fr. c.
1	18	106	Very good..	18 Nov.	13	90	Good ..	30 Nov.	13	82	15	30	Good ..	0 50
2	16	35	Middling ..	23 Nov.	13	88	Middling..	6 Dec.	13	80	18	35	Middling ..	0 35
3	19	70	Good ..	25 Nov.	12	90	Good ..	13 Dec.	13	80	20	40	Very good..	0 50

CHAPTER VIII.

Diseases of Cheese and their Remedies.

THERE are many causes which hinder the manufacture of good cheese, and ruin its quality. There are defective milks, such as acid, blue, red, yellow, bitter, as well as that which the cows give at the end of their period of lactation, which produce with dirty stalls, dairy, and utensils, those diseases in cheese oftenest due to the abnormal development of particular ferments.

The air of the cattle-sheds and dairies is peopled with an infinity of microbes. Some of them are useful to produce the ripening of the cheese, and should be encouraged for that use; the others are harmful and should be removed. The best way to do this is to exercise rigorous cleanliness in the neighbourhood and apparatus of the dairy.

The dishes and other utensils used in the manufacture should be washed in boiling water and soda, and rinsed afterwards in cold water.

The milk should never remain in the cow-sheds; it should be removed from there as soon as it is drawn.

The cow's udder should be washed in lukewarm water, and also the milker's hands.

It is well to fasten the animal's tail to one of its legs to preserve the milk from dust and dirt which might be shaken into it.

The *colostrum* or milk which the cows give the week before and the week after calving has properties which render it unfit to be used for cheese-making; but, in return, it constitutes for the newly-born calf a food of the first quality, which is unfortunately too seldom given because of ignorant prejudice.

Milk attacked by disease is not good for manufacture; every time it appears abnormal the best plan is not to use it, but to find the cause of the ill and remedy it.

It is as well to taste the milk of each cow from time to time, for one bad milk is sufficient to spoil the lot. If the draining takes place too quickly, owing to too great heat in the dairy, the fermentation of the cheese in the drying-room is very slow.

If the drainage is too slow on the contrary, the fermentation is irregular, and the outside of the cheese begins to run before the internal part has begun to ferment.

Cheeses made with milk which is too fat quickly gain a pungent taste, due no doubt to the butyrate of ammonia. The mould which covers the cheeses, instead of remaining light and of clear blue, soon passes to a dark-green then to black.

This accident, which often occurs in a newly constructed dairy, is due to an excess of dampness which may easily be avoided by following the directions already given.

This black mould sometimes invades the cellars and causes considerable ravages. In order to get rid of it, it is necessary, according to Hertz, to wash the cheeses with a weak solution of lactic acid. Pourian advises the use of carbonate of potash contained in new wood ashes. He says—"Well mix with salt 10 per cent. wood ashes, very finely sifted, and salt the cheeses with the mixture." If in spite of the good quality of the milk and the care taken in its manufacture the cheese is not a success owing to bad fermentation, stop the making of it, wash the rooms, shelves, walls, and utensils with a solution of bi-sulphate of lime; afterwards burn sulphur, closing all openings to prevent the escape of the sulphuric acid, and by this means destroy all microbes. Some days afterwards, air the factory, wash everything with hot water, and recommence operations.

CHAPTER IX.

Parasites in Cheese.

THE parasites in cheese are maggots and mites. The first you find in soft cheese, but the mites generally in hard cheese. The maggots are nothing else but larvæ of flies. There are two kinds of flies which specially attack cheese; one is the house fly, *Musca domestica*; the other, more formidable, is called *Piophila casei*, and is only half the size of the first one. It lays its eggs in summer on the cheese, and in two or three days the larvæ, generally called maggots, will appear. These maggots change into chrysalids, which in their turn produce fresh flies. The house fly acts in the same manner, but its chrysalids are much larger.

As soon as the presence of these parasites is observed the cheeses attacked must be washed with a very concentrated solution of salt, and all the special spots where they are found with carbonate of potash. The best plan, however, is to prevent this evil by covering every opening in the factory with very fine metallic nets.

CHAPTER X.

No. 1.—Results—Quantity of Cheese.

WE have mentioned before that an average of 2 litres of milk is required to make one Camembert cheese.

The six spoonfuls of curd corresponding to this quantity weigh about 1,850 grammes, the drained cheese 400 to 410 grammes. After paring, 325 grammes, and when properly matured only about 300 to 315 grammes.

Taking these figures as a guide we find that 100 litres of milk should give—

	k.
Fresh Curd	92·500
Drained Cheese	20·000 to 20·500
Dried Cheese	16·250
Eatable Cheese	15·000 to 15·750

Residuum.—The whey from 100 litres of milk can be estimated at 80 kilogrammes, but in reality you only get about 70, as you must take into account the loss during draining.

Besides the soluble matters in the milk, this whey contains more or less of other elements—butter, casein, and phosphate of lime—in variable proportions according to the mode of manufacture.

The whey is generally used for feeding pigs. It is not a complete food, because its nutritive proportions, that is, the proportion between the azotic matter and extractive matter, is only one-seventh, and ought to be one-fourth; but by the addition of barley-meal, oil-cake, &c., the percentage of nitrogen is increased, and it becomes a very nourishing food. It can also be used for fattening calves and cattle, but should never be given to milch-cows, because the acidity is transferred to the milk, and deteriorates the quality. In certain agricultural work it is mixed with liquid manure, and used for irrigating.

No. 2.—Transport and Sale of the Cheese.

Camemberts are divided into three grades. 1st, perfect; 2nd, medium, where the mould has developed irregularly, and where the shape is bad; 3rd, badly made, or defectively ripened ones. The cheese spoils much easier in summer, and the proportion of bad ones is much larger.

Out of 100 Camemberts made, you may reckon on 60 of No. 1, 30 of No. 2, and 10 of No. 3 grade.

The perfect cheeses are wrapped in paraffin or albumin papers, and put in wooden boxes, the covers having a ticket with the trade-mark and name of maker. The second quality are wrapped in the same manner, but the mark is different. The boxes, which cost from 35 to 50 francs per 1,000, are placed in cases and sent to Paris. With regard to No. 3 quality, three cheeses are placed in a straw basket, with a round piece of paper between each. The products from the large cheese factories are sold by cheese-dealers at the Halle de Paris (public markets).

Certain dealers in Paris buy unfinished cheeses and keep them in special cellars, where they are ripened more or less quickly according to the demand. Good Camemberts fetch in winter 60 to 80 francs per 100, and the poorer ones 30 to 40 francs. During summer the prices are less, the good ones not fetching more than 40 to 45 francs per 100, while the inferior ones fall sometimes as low as 20 francs.

Generally speaking, the prices are lowest when the fruit crop is abundant.

Chapter XI.

Technical Arrangement and Plan of Cheese Factory.

In establishing a dairy choose a very dry spot away from the cow-sheds chimney-pots, manure heaps, &c. If obliged to build on a damp ground, it is indispensable to surround the building with a draining channel. Water should be obtainable in the different rooms of the dairy, and should be fresh and as cold as possible, to ensure the preservation of the milk in summer.

We consider as a model cheese dairy, one in which the raw material is received at one end and sent out at the other end in the form of finished cheeses, ready for the trade, which conditions are realised in the plan below. The building contains cleaning-room, mixing-room, drying-room, and cellar. It should be built of materials which are bad conductors of heat, so as to keep the temperature low and constant during the whole season. Every room should have a thermometer.

The Cleaning-room.—We have said that cleanliness is the first condition for a successful milk industry. Therefore, it is of the greatest importance to have in the cheese dairy a cleaning-room, where all the utensils can be washed in boiling water and soda, and rinsed in cold water before being used.

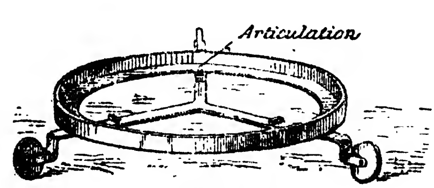


Fig. 12.

The cleaning-room contains a cistern for cold water, and another cistern with hot and cold water tap.

It should also have a basin of hydraulic cement, where the evening's milk may be preserved until morning in ca: s round which circulates a constant stream of cold water.

The cleaning-room is also provided with a receptacle in which the milks are mixed on arrival, and contains the moulds, pails with their stands (fig. 12), spoons, paring knives, curd ladles, trays, and all the necessary tools for cleaning the factory and utensils.

The Mixing-room.—In this there ought to be no current of air, because it is essential for the temperature to be constant during coagulation. The milk is pumped from the cleaning to the mixing room, and heated in a reservoir communicating with the multitubular heater, which elevates the temperature to the desired degree for putting in the rennet.

Cheese-room proper (or dressing-room).—This is the room where the cheese is put in mould, drained, and salted, and communicates directly with the cleaning-room, mixing-room, and vestibule. It must be well lighted, and should be ventilated at will. The floor must be made of material not affected by whey, such as Dutch brick, English stone flags, or, still better, bitumen or asphalt, as there is no danger from fire, as in the making of Gruyère. It should have a convenient slope, to enable the water to run off easily, with a discharge pipe, and siphon grid, preventing any gas from entering. The room is furnished with dressers and shelves, on which the cheeses are deposited when taken from the mould. The pails containing the curd are moved on their wheel-stands round the dressers, and remain in the cleaning-room when empty. The draining-slabs are of pine, and incline towards the gutters; the iron feet which support them are sunk into the floor. The whey from the cheese runs towards the gutter, and is carried to a separate cistern.

In winter the heating of the cheese and mixing rooms should preferably be done by steam.

The Vestibule.—This is situated between the dressing-room (or cheese-room proper) and the cellar, as it is of importance that this latter is not heated by being in direct proximity with the former. In the vestibule there is a staircase from the cellar to the drying-room, and a lift for transporting the cheeses to the drying-room when taken from the dressing-room.

The Drying-room is on the first floor, and is furnished with wooden shelves (Fig. 13). The windows ought to be placed between them in such a manner as to have the least direct current of air on the cheeses.

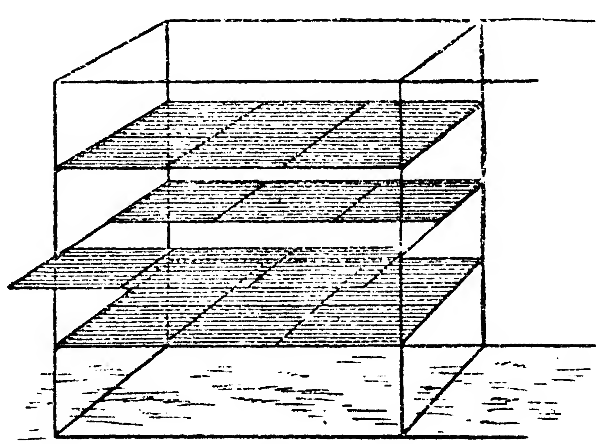


Fig. 13.

Cellar.—When the ground is dry the cellar should be a few steps below the surface; if damp, it is preferable to have it on the ground floor, and in this case the floor instead of being formed of hard soil or brick, should be of beton, covered with a layer of hydraulic cement.

In the middle of the cellar are the cheese shelves and racks, and psychrometer, indicating at each hour the temperature and hygrometric condition.

Finally, it is indispensable that the drying-room and cellar should have double doors.

Brie Cheese.

Brie cheese is made in several provinces, but it is particularly in Seine-et-Marne and the districts of Meaux and Coulommiers that this industry is of most importance. Its preparation very much resembles that of Camembert. It only differs a little in the rennetising of the milk, so that for the most part what we have said about Camembert will apply just as well to Brie.

The method of manufacture practised in the most celebrated farms of Brie is as follows:—

As soon as it is drawn from the cow the milk is poured into a receptacle through a very fine and close sieve, which cleanses it of most of its impurities, then it is sent to the dairy.

Then, its temperature being about 34 degrees, it is cooled with a little skimmed milk kept from the preceding milking, and when it is lowered to 27, 28, or 30 degrees, according as it is winter or summer, some drops of colouring are added with the rennet.

The rennet generally used possesses a coagulating strength of 10,000.

During the greatest heat of summer about 14 grammes should be used, whilst in winter it requires 17 grammes to 100 litres of milk.

By taking note of the temperature of the milk and its acidity, a cheese-maker is very soon able to decide, between these two limits, the precise dose required to produce coagulation in two hours or two hours and a half.

In the making of Brie, as in that of all other quickly ripening cheese, the curd requires to be loose, not very coherent. If too large a quantity of the coagulating agent is used the coagulum becomes hard and brittle, and the whey runs too abundantly; if, on the contrary, too little is employed, the curd remains very watery, retains its serum, and the drainage is interminable. As before stated, the same means are employed in dressing the cheese as for Camembert, when coagulation is finished.

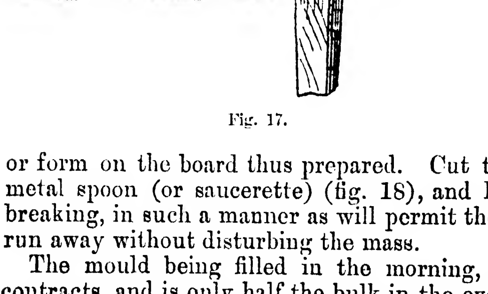


Fig. 17.

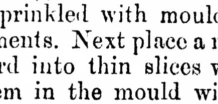


Fig. 18.

For this purpose a board is placed on the draining-table furnished with a wicker tray (fig. 17), the surface of which is sprinkled with mould and ferments. Next place a mould or form on the board thus prepared. Cut the curd into thin slices with a metal spoon (or saucerette) (fig. 18), and lay them in the mould without breaking, in such a manner as will permit the principal part of the serum to run away without disturbing the mass.

The mould being filled in the morning, the coagulum sinks down and contracts, and is only half the bulk in the evening. Then remove with the hand the pieces which stick to the sides of the mould and fill it up again

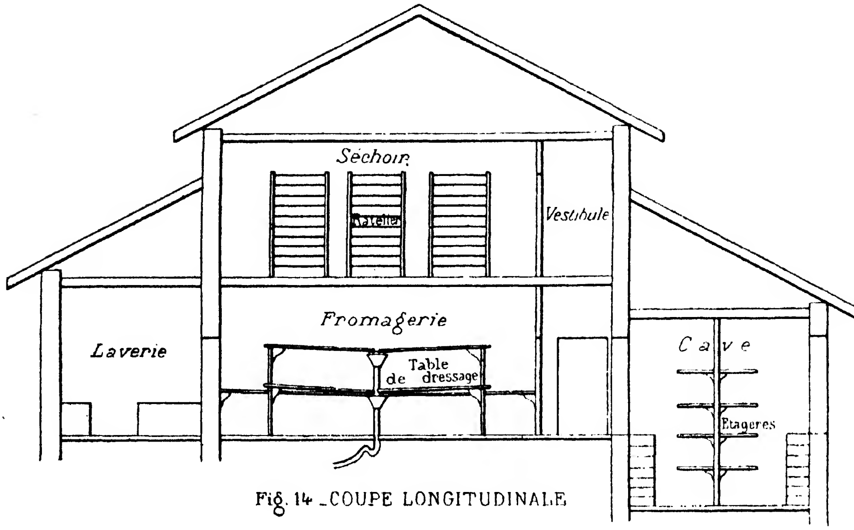


Fig. 14 _COUPE LONGITUDINALE

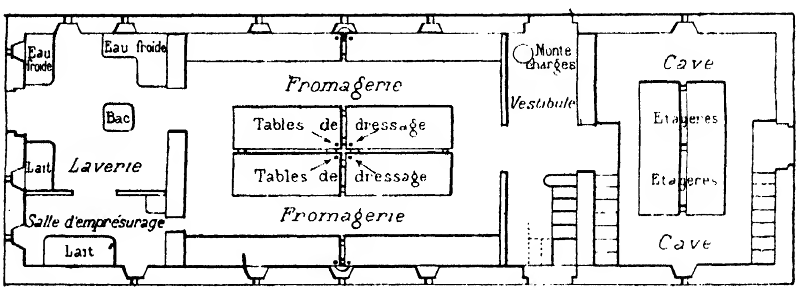


Fig. 15 _PLAN DU REZ-DE-CHAUSSEE

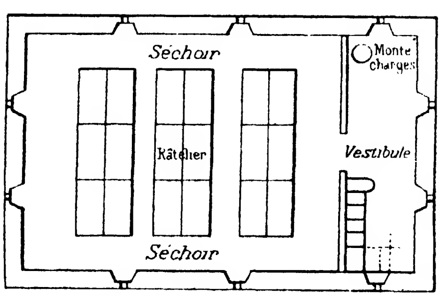


Fig. 16 _PLAN DU SÉCHOIR

TRANSLATION OF TERMS. (Figs. 14, 15, 16.)

Laverie (cleaning room).
Salle dèmprésurage (mixing room).
Fromagerie (cheese room or dressing room).
Vestibule (vestibule).
Séchoir (drying room).
Cave (cellar).

Etageres, Râteliers (shelves).
Eau froide (cold water).
Lait (milk).
Monte-charges (lifts).
Rez-de-Chaussee (ground floor).

with curd from the following milking. The two layers of curd deposited with an interval of twelve hours will adhere perfectly if the coagulation has been regular, and if the operation is properly performed, otherwise the adhesion is bad and the cheeses separate in two pieces. On certain farms this inconvenience is avoided by performing the dressing or moulding in one operation. In this way, two moulds are placed on top of each other, and filled with curd. The bulk will be sufficiently reduced in twelve hours to allow of the top mould being removed. Whichever mode is employed the cheese is sufficiently drained after twenty-four hours to admit of the mould being replaced by a wooden rim (fig. 22), and turned between two boards. The cake of curd dries for twelve hours, then the upper surface is salted, and after the lapse of another twelve hours the rim or hoop is removed, and the bottom and sides of the cheese are salted. The salt used should be very fine, dry, and slightly warmed. On the farms it is generally dried at a low temperature by the fire or in the oven, and afterwards pulverised in a mortar before being used.

The salting should be very uniform for the reason given in reference to Camemberts.

Twelve hours after this the cheese is turned over upon a wicker tray, and removed to the drying-room, and from this time it must be turned every day.

It is on these same trays that the curd is deposited when placed in the moulds. The mould develops rapidly on the cake of curd, and soon covers the whole of it, and as it destroys the acidity in the interior a reddish colour appears, and also the ferments of caseine, which change this latter into caseone. All that has been said with respect to the ripening of Camembert is equally applicable to Brie.

It is at this stage that the cheeses from Seine-et-Marne are generally sold. The ripening follows the same plan as with Camembert, but instead of taking place at the factory is finished in conditioning cellars at the dealers.

The cheeses sent to the market at Meaux are made with a little more rennet and colouring than those for the Coulommiers market; these latter ought only to be covered with white mould, whilst on the former red should mix with white over the whole surface.

Thirteen litres of milk are required to make a medium-sized cheese, and twenty for a large one.

Arrangement of Cheese Dairies in the Brie Farms.

Most of the cheeses made in the Brie farms are delivered to the trade a fortnight after being taken from the drying-room, without having been in the finishing cellar.

Generally these dairies comprise a cleaning-room, dressing-room, and drying-room.

The Cleaning-room has a fire-place and heater for the water used in washing the utensils. A hand-pump brings the cold water to the large cisterns, and the washing is done over the sink.

In winter the fire-place serves to heat the dressing-room, and maintain its temperature tolerably even.

The Dressing or Moulding Room.—This room, where the rennet is applied to the milk and the moulding done, should have a temperature of about 18 degrees.

It contains the draining-table of wood or stone, slightly inclined, and crosses lengthwise by large grooves all terminating in a gutter, with a hole

in the middle for the escape of whey. This serum is very acid, and to prevent it affecting the wood or stone, a sheet of lead or tin is fixed upon the drainer.

In this dressing-room are the various utensils—moulds, boards, trays, wooden hoops, spoons or saucerettes, and bottles containing colouring and rennet. The moulds (fig. 19) are hoops of pine, beech, or tin, 2 to $2\frac{1}{4}$ inches high. They are principally in three sizes—large ones, 16 inches in diameter; medium, 13 inches; and small ones, 6 inches, used specially for cheeses called Coulommier. The boards (fig. 17) are smooth, with rounded corners, and are about an inch larger than the diameter of the moulds.

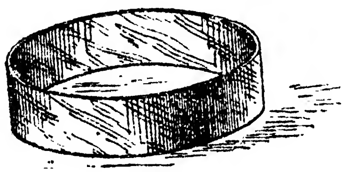


Fig. 19.

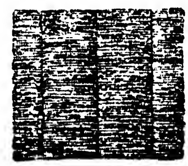


Fig. 20.

The mats (fig. 17 and 20) are made of cane, rush, or straw, and are woven at the farms during winter evenings by a machine shown in fig. 21. The wicker trays are pretty open, and of a size according with the cheeses (fig. 7).

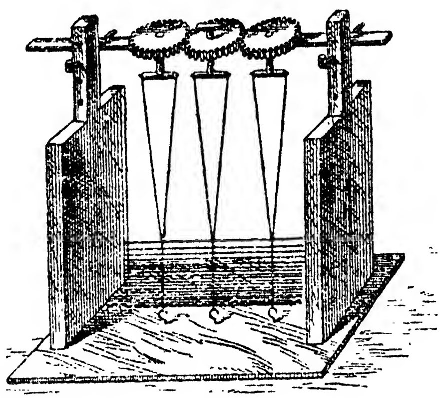


Fig. 21.

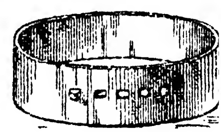


Fig. 22.

The hoops (fig. 22) are moulds of tin, and can be altered in diameter by means of copper studs, which fit into corresponding holes. Round the walls, over the draining and salting tables are shelves on which the cheeses are placed when taken from the moulds.

The Drying-room is arranged in the same way as for Camemberts, and all the same conditions of temperature, moisture, airing, and ventilation, are applied also to Brie cheese.

The plan and explanations given (figs. 14, 15, 16) are equally suited to a factory where Brie is made.

Trials of Commercial Crops at the Richmond River Experiment Farm.

G. M. McKEOWN.

Pea-nuts (*Arachis hypoyda*).

Two varieties of these have been regularly grown at the farm with satisfactory results both as to quantity and quality of crop.

The method of planting which has been found most desirable has been that of sowing in drills 3 feet apart, with the seeds from 12 to 15 inches apart in the drills, the former distance being sufficient for the small variety.

Shallow-ploughed land has proved the best, as the nuts are, under this system, much more easily harvested than in deeply-worked land in which the bearing rootlets can penetrate to too great a depth to admit of the nuts being easily got out, thus leaving a considerable portion of the crop in the ground.

As it is impossible to harvest the entire crop, fowls or pigs confined within portable pens, or, where convenient, allowed to run freely for a time, will gather most of the remaining nuts with advantage to themselves and the grower.

Experiments locally made in this manner have shown an increased egg-production, while fowls have been allowed to gather the nuts which otherwise would have been lost.

The cost of tillage has been light, as the plants have quickly shaded the ground and prevented the growth of weeds, and as in the light volcanic soil of this locality the surface never becomes "crusted" the bearing roots have at all times been able to penetrate the soil with ease.

The yield of the small variety, which is the finer flavoured, has varied from 18 cwt. to 1 ton 13 cwt. per acre, while the larger kind has in two seasons produced 2 tons 4 cwt. and 2 tons 5 cwt. per acre respectively.

The quotation received from the Sydney market has been 2½d. per lb. for fairly large parcels, the price obtainable locally being 3d. per lb., in the latter case the demand being limited.

Should the manufacture of oil from pea-nuts be taken in hand the consumption would very largely increase, but even now a good market may be found for far more than are produced in the colony.

Turmeric (*Curcuma longa*).

The first test of this crop proved a comparative failure, but the succeeding season, roots raised on the farm were planted under similar conditions and gave a good yield.

The method of planting has been that of placing portions of the divided "stools" in drills and covering them with about 3 inches of fine soil, the plants having been slightly earthed up after some growth was made. The

drills were set out 3 feet apart, with the plants 1 foot apart in the drills, but the distance between the drills might be reduced without disadvantage if the crop be not cultivated on a large scale, where horse labour would be required.

The crop has occupied the ground for about eight months, the yield of "green" turmeric being at the rate of four tons per acre.

A sample was sent to a Sydney firm of condiment merchants, who valued it at 3d. per lb., which would give a gross return of £28 per acre.

Arrowroot (*Canna edulis*).

This crop has been successfully produced throughout the north coast districts, and especially so on the rich lowlands.

It has proved easy of cultivation in the light porous soil of the farm, its rapid growth effectually preventing the growth of weeds, as they were not allowed a chance of starting before the crop had obtained a good hold.

Single rhizomes have been planted in deeply ploughed land in September, in rows 4 feet apart, the plants being placed 3 feet apart in the rows.

Beyond an occasional stirring of the soil in the early stages of the growth of the plants, not much labour has been required in the production of a crop.

With a limited supply of water, and the primitive appliances at our command, viz., a crusher made of perforated galvanized iron fitted on a wooden roller, we have manufactured arrowroot of good marketable quality, at the rate of 18 cwt. per acre.

With good machinery and a copious supply of water, this yield, however, should be considerably increased.

A small area has been used to test the growth of the Bermuda arrowroot (*Maranta arundinacea*), which has yielded tubers at the rate of 8 tons per acre. As the tubers, however, were required for planting, no attempt was made to extract starch from this variety.

Rice (*Oryza sativa*).

Three varieties of "upland" or mountain rice have been tried, viz., Kyba Saba, Madagascar, and Japan. The most favourable sites for the retention of moisture were selected for sowing, and the seed was sown both in drills and broadcast.

The first named varieties produced good crops of fodder, the Kyba making excellent hay, but very little grain resulted, and that was of inferior quality.

The Japan variety yielded 17 cwt. of paddy per acre plump and well filled, but badly discoloured by rust, which attacks almost all grain or fodder crops to some extent in the red soil of this locality.

The soil not being sufficiently retentive of moisture this crop must, on these high lands, always be a precarious one, as the effect of even one dry hot week is apparent upon it.

It is, however, well worthy of extended trials on the river flats of the north coast, where its chances of success would be greatly increased.

Ramie, or China Grass (*Boehmeria nivea*).

This plant has grown with great luxuriance, especially when a fair rainfall has been obtained.

The method of cultivation carried out on the farm has been that of subsoiling the land to the depth of a foot, and forming into wide ridges. Divided roots have been planted in the middle of the ridges, about 15 inches apart, in rows 4 feet apart. When preparing "ribbons" or bark, all leaves

and a large quantity of the stripped canes have been restored to the soil, by which means its productiveness should be considerably prolonged.

The growth has been so rapid, that a plot planted as above described 18 months ago now forms a mass of canes.

Samples of bark or ribbons have been prepared and sent to London manufacturers for report as to quality, and should the result prove favourable the industry should prove a payable one, as the quantity produced compares favourably with that of other countries.

The process of preparing samples by hand is tedious and expensive, and cannot be as effective as the preparation of "ribbons" by machinery, as a portion of the fibre is lost in hand-stripping, it being difficult to treat the crop with sufficient speed when it is ready. A few hot days will render the bark too adhesive to allow of the fibre being entirely removed, which would not be the case if a machine were available for removing the stems by crushing.

At present there is at the farm a parcel of ribbons from 4 feet to 5 feet 6 inches in length.

Ginger (*Zingiber officinale*).

A small area was last season planted with a view to testing the suitability of soil and climate for the production of ginger, but the result was a failure, the crop being merely nominal.

A second planting was made in September last in the best soil available, to which manure was applied at the time of sowing, but so far it does not promise very satisfactory results.

Excellent results have been obtained in the rich sandy loams of the Lower Clarence, but apparently the red volcanic soil of the "Big Scrub" is not suited for the profitable production of ginger.

Jute (*Corchorus olitorius*).

Three tests of this fibre plant have been made under various conditions, but in all cases the result has been unsatisfactory, the plants being stunted and spreading in growth, and useless for fibre. In all probability much better results would be obtained on the river flats.

Sunn Hemp (*Crotalaria juncea*).

Seed has only been available for one test, which proved a failure, the crop being stunted and weak.

Flax (*Linum usitatissimum*).

Seed has been sown at various periods to find the best time for sowing for a crop. It has, however, always proved an uncertain crop, the only favourable result having been obtained from a plot sown in April last.

The plants then grew to a height of about 2 feet before branching. Linseed of good quality was harvested at the rate of 800 lb. per acre, but owing to its irregular ripening, a quantity of seed was unavoidably lost, as the earliest commenced to "shed" before the last matured.

Castor Oil (*Ricinus communis*).

The best variety for commercial purposes was procured from the Queensland Department of Agriculture, and tried under varying conditions. A luxuriant growth and promises of heavy crops have always been obtained,

but owing to the effects of excessive moisture and borers, the quantity reaching maturity has been only nominal.

In warm moist weather, almost all the largest clusters rot from the base upwards, leaving only a few berries on the top.

Borers also attack the stems, doing considerable damage to the berries by preventing their maturing.

There is, therefore, little probability of this proving a profitable crop in this locality.

Potatoes.

Fourteen varieties were tested in land having a few small stones in it, and which had previously been well broken to the depth of a foot by subsoiling.

The sets were placed on 8th September in drills 3 feet apart by 1 foot apart in the drills, and when well above ground they were "hilled." The "hill" system of cultivation is necessary in the light soil of our high lands to protect the tubers from injury by the excessive heat which prevails in the summer.

The season proved moist and favourable till November, when an excessive rainfall was experienced, which, however, beyond exposing some of the tubers temporarily, did not do much damage to the crop.

The effect of the Colonial Sugar Co.'s superphosphate manure, No. 6, containing 7 per cent. potash, was tried on all varieties except Breese's Peerless, an equal area being planted with and without manure respectively. The manure was sown in the drills at the rate of 4 cwt. per acre, valued at £1 6s. per acre. The result of the application was very satisfactory, an increased yield having been obtained from all varieties, varying from 6 cwt. to 3 tons 2 cwt. each per acre, three varieties only failing to show a profit.

The only kind which suffered seriously from the attacks of insects was Robin Adair, which was badly damaged at an early stage by grasshoppers. One spraying with Paris green was all that was found necessary for the others.

The tubers of all varieties except Robin Adair, Early Vermont, and Early Puritan were of good size and even quality, this being especially the case with those showing the highest yields. Subjoined is a table showing results:—

Variety.	Yield per acre.							
	Manured.				Unmanured.			
	T.	c.	qr.	lb.	T.	c.	qr.	lb.
Imperator	12	11	1	20	10	10	3	4
Breese's Peerless	11	7	3	12	....	.....		
Imperial Blue	10	12	0	16	7	10	0	0
The Dean	8	12	3	12	7	19	0	20
Early Rose	7	19	0	20	5	2	0	16
Irish Flounder	7	1	1	20	4	14	0	0
Satisfaction	6	13	2	8	5	17	3	12
Brownell's Beauty	6	11	2	12	5	6	3	24
Reading Russet	6	9	2	16	5	2	0	16
Early Puritan	5	17	3	12	5	11	3	24
Early Vermont	5	10	0	0	4	6	1	20
Bliss' Triumph	4	18	0	2	3	10	1	14
Federation	4	16	1	0	3	2	3	12
Robin Adair	2	5	0	17	1	17	1	8

Handling Fresh Fruit.

C. GORMAN.
Pera Bore Experiment Farm.

THE present year's crop seems to have given general dissatisfaction to the grower, and from a producer's point of view it seems to have been one of the best for many years. People must sympathise with the Central Cumberland growers on account of their loss through weather, &c., and no doubt other districts have suffered in this respect. But what I want to arrive at is, why do those people engaged in fruit-growing blame the public for not buying their fruit? One hears the majority of growers remarking that there is nothing in it, and that when the fruit is produced it cannot be sold. Quite right. The bulk of fruit this year has been unfit for sale; but if proper marketable fruit is produced it will sell readily. The truth of the matter is, everybody seems to go for quantity. As long as a big crop is procured, no attention is paid to the quality. Now, I contend this, that the public will pay any price for good fruit, but when a lot of inferior stuff is put before them they refuse to have anything to do with it, and as a consequence the grower blames the buyer instead of blaming himself. Of course, this sort of thing has often happened before, and yet no means are taken to rectify the error. Inferior fruit is grown; it is handled carelessly, packed disgracefully—in fact, not packed at all—and marketed anyway. I am speaking from my own observations, and my remarks are not meant as offensive, or do they refer to all growers. Fortunately, we have some careful and painstaking growers, but they are in a sad majority. How many go in for a proper system of thinning their fruit? Very few, I'm afraid, or we would not see that miserable fruit exhibited in shops. One can hardly blame the buyers (wholesale, I mean) because, in some cases they know no better. But the public, who travel a little, say to themselves, "We've seen better fruit than that, and we won't buy it." How much better it is by thinning out half the fruit and getting double the price for it, than letting the tree mature all its fruit, and getting half the price. By thinning and producing quality as well as quantity, a grower makes his name or brand known, and consequently can always sell. Some growers say, "Oh, let it go; the tree will thin itself"; but in the meantime it matures more than it ought, and a lot of nourishment goes to the fruit that ought to be assisting the tree. Thus, at the same time as miserable fruit is being produced, the tree is suffering. What I wish to point out to every grower is, thin out your crop, mature good, clean fruit, and the public will not only thank you for it, but pay you well for it.

Now, again, is another important point—the system of packing. If a thing is worth doing, it is worth doing well; and fruit-packing is worth doing well. When a box of fruit is opened something attractively put up

ought to be seen, not a lot of fruit pulp covered with a sheet of newspaper. Good packing adds 25 per cent. to the value of fruit. Very many points have to be taken into consideration in packing. First and foremost, fruit must not be so ripe that it will squash or break at picking time. Pick early in the morning or late at night, and be very careful in handling. Do not use boxes that when full cause the fruit on the bottom to break. A picking box or basket should not hold more than 20 to 25 lb. of fruit; then be careful when carrying from orchard to packing shed. When in the shed, grading should start. Keep the different sizes together, and call them according to size and quality, such as 1st grade, 2nd grade, &c. There are many ways of packing; but to my mind the chip-basket system is the best. The baskets hold either 3 or 5 lb. of fruit, and the fruit is put in with leaves, cotton wool, or ti-tree bark between. Do not allow the fruit to press against the sides or it may bruise. A box to contain 18 or 20 baskets should be provided, and small lath frames placed between each row of baskets, so that the bottom of the baskets will not press down on the fruit in the lower baskets. These boxes are then made fast with padlocks as a rule, but ordinary binding wire in many cases. Every basket must be made to fit tight, but not in any way to injure the fruit. When packed, always keep the box turned right side up. This is a point that should always be watched in any way of packing. When the crates reach the buyer, the baskets are removed and frames and crates sent back to the grower. In the long run it pays to follow out this system of packing, not only that it is an attractive way of putting the fruit up in order to catch the eye of the public. The baskets are very cheap and always go with the fruit. I would strongly urge our growers to try this system, as I have no doubt as to its ultimate success and adoption by leading growers. I speak from practical experience on this subject, except that in my case the fruit was sent something like a distance of 500 miles, and of that only 200 by rail. Fruit of any kind may be packed this way; there is no special fruit alluded to, because I take all classes and varieties. If the majority of our growers will only look at the handling and packing of fresh fruit in the right way, we will not so often hear these remarks about growers being unable to dispose of their market fruits.

Another system which requires just as much care and attention is one that is well known, but no doubt will stand being referred to in this article. The size of the box is 22 in. x 10 in. x 11 in., and contains about 50 lb. of fruit, with a division. Practically it is the old lemon case, and is used in California principally for apples. For such fruits as apricots, peaches, and figs, which bruise easily, I prefer the half-case. This case allows of only three or four layers, and with large fruit only three. Each fruit is wrapped carefully in papers specially prepared for that purpose. Then one layer is put on the bottom, fitting firmly, but not pressing hard enough to bruise. If there is an open space between the fruit, do not try and ram a smaller fruit in, rather fill the gap with ti-tree bark, sawdust, or cotton wool. The second layer is not put exactly on top of the first, but rests between the gaps of the underneath layer, thus to a certain extent giving a better hold. The third layer then has the same position as the first, and no matter where the box is opened, both top and bottom layers are similar. Do not put newspaper between the layers or, in fact, anywhere in the box; there is a certain taint given wherever newspaper is used. The cases should be branded neatly with the grower's brand or name. Firebrands are in many cases used, and present a neat and clean appearance. When the boxes are all ready they should be taken with as little handling as possible to the railway station, being careful to have them put in a truck that is protected from the sun's rays. Louvre

cars are the best for fresh-fruit shipping, and as our Railway Department have many at their disposal, it ought not be a difficult matter to obtain them for districts where much fruit is produced. Once obtain a good name as a producer, and there will be no need to complain about the public not buying. Keep up your standard, and whatever fruit you have not fit for choice table fruit make into jam or send to the factories. Growers will find that if the public know they can be depended on, their fruit is virtually sold before matured. I would like to see a central depôt started where only the very best fruit is sold, either wholesale or retail, and worked on the co-operative principle, and before very long, if only growers will work together, this end may be attained.

Notes on Wine-making.

By M. BLUNNO.

It is understood that a discussion on wine-making at this time of the year should deal with seasonable arguments, such as the picking of the grapes, crushing same, fermentation, drawing off the wine, slow fermentation and the first racking. The fermentation will comprise the following other subjects:—The cooling down of the must, the aeration, and the question of *levures pures.*

Wine-making has now so much improved under scientific methods that to deal fully with every part of it we should have to meet again and again, although I am convinced that far more advantage could be taken by each vigneron from my visit to his own vineyard and cellar in an hour of talk, in which we could fully discuss the technical questions according to his particular conditions, and by arranging matters this way I hope to be able to visit every cellar during the coming vintage.

I do not think it is necessary for me to say that a fortnight before the gathering of the crop the wine-maker should commence by cleaning and repairing all tools and machines, and so fit them for the work. As a rule when the vintage is over you swab and daub your fermenting vats and tubs with a solution of quick-lime to prevent any alteration of the wood through moulds and other infestant organisms, and it is now necessary that the coat of lime be scraped off and the vessels washed with clean water several times by means of a hard brush until every bit of lime is taken away.

This coating of lime is removed quicker and more completely if, for the first washing, water acidulated with sulphuric acid is used in the proportion of ½ pint of the latter to each gallon of water, being careful not to allow the solution to come in actual contact with any piece of ironwork, such as the screw of the press or of the mill, &c. Then wash twice with clean water, so as to get free from all traces of sulphuric acid. The walls of the cellar should also be limewashed and strips of sulphur burned in different corners to destroy any noxious germs floating in the air, and to have a sound clean ambient all round where the several operations of the wine-making are to be carried out. The bottom floor of the press, by getting dry, is very often subject to split, but by spreading warm water on it the pieces of which it is made will join again. The screw wants to be lubricated, also the joints of the levers.

According to the importance of the vintage every one will have a supply of buckets, a long table on which to cull out all rotten grapes and berries, and several tubs of the proper size. It occurs very frequently to vignerons to use tools and receptacles for white musts that have previously been used for red ones, so that the white wine gets a pink colour that is of no commercial value, unless it be used either in blending or the making of a wine of special category. With the exception of these two cases, the intelligent wine-maker may avoid this inconvenience by properly washing the tools and

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* These notes were written for a lecture to be delivered before vintage in the Murray Vine Districts, and apply specially to the conditions of those districts. Certain modifications would be necessary to meet the circumstances of the Hunter.

machines used for red musts or wines with warm water, into which ½ a pint of caustic soda to the gallon has been mixed, and afterwards with a solution of 1 gallon of water and ½ a pint of sulphuric acid. After this, wash several times in pure water. This is considered the best way to get rid of the red colouring matter (*oenocyanine*) in every instance, and by only strengthening the doses of the soda and the acid the above solutions are the best to prepare a cask for keeping white wine which has previously been used for red ones. In big wineries there is always a steam generator, by means of which, injecting the steam at one atmosphere of pressure, the cleansing of tools, vessels, and casks, is better achieved.

Gathering the Grapes.

When grapes shall be gathered.—No peremptory time may be suggested, for you yourself know how different is the period of the ripening according to the many varieties of grapes you grow. Some vineyards are almost a mosaic, so numerous are the kinds grown, an indecision of type each year is the outcome of this inconvenience, owing to the more or less ripeness attained by each kind, and the more or less yield of it.

But where the number of varieties of red and white grapes are not more than three or four, and are grown in separate areas, then a proper vintage at the right time for each kind may be made.

What are the signals that grapes are ready for the gathering? There are three ways to decide whether the crop has attained its industrial ripeness or not. The first is an empiric way, the second is physical, and the third is chemical. I shall not speak of the latter, it not being practical for vignerons.

When the berries have acquired their normal colour and sweet taste; when in plucking the pedicel from the berry it tears off a part of the pulp very juicy and "licking"; when the skin of the berries on being scratched through the fingers gives out colouring matter plentifully,—then the grapes are ripe, but you can understand how doubtful this empiric way is to give an exact judgment.

Second comes the use of the saccharometer, which is the physical means of ascertaining the correct time to gather the crop.

You know that before grapes ripen there is a period in which they are very rich in acids and very poor in sugar, but the quantity of sugar is always increasing while that of the acids lessens every day, until the quantity of saccharine matter attains its highest proportion. If left after this, the grapes will wither and the absolute quantity of sugar will diminish. But here I think I should give an explanation. I said the absolute quantity of sugar will diminish, and this statement might appear quite in contrast with what you really see each year in grapes left on the vines getting sweeter. Yes, but this is on account of the great quantity of water which is lost by evaporation, so you have the concentration of the must, but the quantity of sugar is really less.

If you take 10 lb. of the juice of fresh grapes at the right time of the vintage you may have, for instance, 2½ lb. of saccharine substance and 7 lb. of water. When you leave the grapes on the vines ten days longer for instance, owing to the evaporation you will have 6 lb. of water and 2¼ lb. of sugar. The juice will be sweeter, but in reality the quantity of sugar has been diminished. This less quantity of sugar is due to physiological combustion inside the berries, so that to avoid any effective waste of sugar we should be able to pick out the very day when the sugar has attained its highest absolute proportion, and this may be done by trying the juice with a

saccharometer. Then for each kind of grape, bunches of average size and from different parts of the vineyard should be gathered, squeezed in a bucket, and the juice filtered through either linen or a flannel, and then measured for its density.

Many saccharometers are used, perhaps too many, and it is highly desirable, for the better understanding of all concerned, to adopt one as a standard through all the wine-growing districts. The Keene's saccharometer, known as the Hunter River saccharometer, is the most common in New South Wales, and is well known. One of its columns gives the specific gravity, the second gives the density expressed in degrees of the Baumé's densimeter, the third gives the percentage of sugar expressed in weight for hundred.

Generally all the saccharometers, either the Keene's, the Guyot, the Baumé's, or the Oecksele, &c., are somewhat misleading, sometimes on account of being imperfectly made, or even when very well made, on account of being influenced not only by the quantity of sugar, but also by other substances such as albuminoids, salts, &c., which are resolved or floating in the must.

The most common saccharometers in Europe are the Guyot's, the Baumé's, and the Babo's. The Guyot's gives the percentage of sugar in weight, but from the number of degrees, 1-11th of this should be subtracted, as this proportion represents approximately the undue influence of other heavy substances which are not saccharine matter.

In the Babo's, the author has already made the correction by calculating to 20 per cent. the quantity of these substances, so that in this saccharometer you read directly the true percentage of sugar without any further calculation.

In the Baumé's each degree corresponds to 1·5 per hundred of sugar, so that if the must marks 14 per cent. Baumé's the quantity of sugar contained in that must will be $14 \times 1{\cdot}5 = 21$ per cent.

The Keene's saccharometer is graduated at 80° Fah., while the Baumé, Guyot, Babo are all graduated at 60° Fah., so that it is important to have the must to be tried at the right temperature according to the pattern of saccharometer to be used. Anyhow, I hope the saccharometer to be adopted in the Colony will be the most exact, and I consider that amongst the others the Babo's saccharometer made by the firm of Kappeller of Vienna should be imported, although a little dearer.

When you have tried your must for three or four consecutive days and each day it shows the same degree of density, then it is time to pick the grapes.

For the vintage buckets are preferrable to baskets in order that the must should not be wasted, and either cases or hogsheads, from which the bottom has been temporally taken away are used to bring the vintage to the cellar. When the vineyard is some distance from the cellar it is desirable that grapes should not be pressed in the case or hogsheads in order to avoid the little must escaping not beginning the fermentation on its way to the cellar, which would occur on account of the great heat of the air, so that it may also happen that the little must turns out vinegar before reaching the place. This suggestion is especially directed to those wine merchants who purchase grapes from vignerons.

For a small quantity of grapes there is no better way to squeeze them than by the feet, the best machine cannot beat them, but it is considered a rather slow way, so that in an important cellar, mills are always used. A good mill should have cylinders made of wood, which is not porous, and the cylinders should be regulated by a spring and a screw to prevent the seeds being broken and the stocks lacerated. You should always refuse to buy mills with cylinders in iron, because the contact with the must, especially if

white, is the cause of a special alteration in the wine. The acids, and especially the tannic acid, of the must attacks the iron, and a salt, say the tannate of iron, is formed. The tannate of iron is the same black substance which is contained in ink, and wines, especially white wines, which have been in contact with any piece of iron, turn out dull or black when exposed to the air.

A question of great importance that is much discussed, and not yet settled, is about the convenience of fermenting grapes with the stocks or without them. Very clever partisans are for the fermentation with the stocks, and many others, not less clever, are against. The belief of the good of the stocks during fermentation is that they are covered with a great quantity of the germ of yeast, and so the fermentation would be more active; that the stocks are rich in tannic acid and other acids, so that these two important elements for keeping sound the wine would be resolved in the same; that the stocks make the marks more pervious, so that more air is mixed, and more active and complete is the fermentation. The very fact is, that chemical analysis of the stocks have shown that they contain a very small quantity of tannin, which is not necessary, because the skins and the seeds are very rich in it, and there is always a surplus, and that the acids are of a peculiar nature, because they are almost all due to racemic acid, which is bitter and gives the stocky taste that you all know; that stocks are rich in albuminoid substances, which are always a danger in the sound keeping of the wine, and that if they are covered with many germs of the yeast they are also covered with the wrong bacteria; and finally, as far as getting more air mixed with the mark is concerned, we may always be able to introduce the air by one of the many means that we shall see further on in this paper.

Again, stocks have this inconvenience: there are some grapes which, as a rule, give a light wine with a thin red colour, poor of tannin and body. For these grapes it would be wise to keep the wine one or two days longer on the skins so as to have more colouring matter, more tannin, and more body; and if there are also the stocks we could not do so without running the risk of a stocky taste, owing to the maceration of them; so that I would suggest that, especially when the vigneron thinks to keep the wine a little longer on the skins, the stems should be taken away.

There are now many machines available which in the meantime smash the grapes and separate them from the stocks; but a small vigneron may do the work by making for himself a sort of netting with strings attached to a wooden frame.

Which do I prefer—the blending of grapes or the blending of wines? There is not much difference, so that it mostly depends on what each vigneron considers easier for himself, always bearing in mind that when you blend wines you may better proportion the quantity of each wine according to the manner the season went on, while the same thing is not so easy to do with grapes.

In our southern districts you know that the red wines of the highest commercial value are the Malbec and the Shiraz, whether blended together or not, and these are really the grapes most cultivated, while the Cabernet, which gives softness and delicateness to the wine, is unluckily in less proportion, the Mataro, Grenache, &c., coming in the third place.

Of white grapes you mostly prefer to make wines separately, and according to the different aim each one of you wish to attain the blending is adopted or not. I have tasted almost each cask in your district, and I am convinced that you should make red wines fully bodied, which in every country of the world are of the most commercial value.

With your Muscat you should make sweet Muscat, and with your white grapes you should make a type of wine of the same category as Sherry. I do not say you ought to call it Sherry; no, you may call it any name you like, but the wine should belong to the category of the Sherry. You do not need to ape any country of the world so long as you have so many favourable conditions to be original. Red dessert wines of the category of Port and Madeira may be made also, bearing in mind the suggestions made for the Sherry type. I shall deal with the technical information about some of these specialities later on in this paper, but now it is necessary to come back to a general argument, namely, fermentation.

Fermentation.

The great trouble of the southern district is the difficulty of having a regular fermentation, not too violent and tumultuous, but smoother, without attaining that temperature of 94 deg. Fah. to 95 deg. Fah., at which the wine may be spoiled by the forthcoming wrong bacteria, which turn the liquid into a nauseous beverage. When fermentation is too rapid in this country there is always the danger of a wine of an inferior quality.

What is the cause of such troublesome fermentation?

1st. The initial temperature of the must when put into the vat is already too high.

2nd. Your musts are too rich in saccharine matter, and rather poor in fixed acidity.

Now we know which are the enemies of a pure fermentation, so that we may be able to fight against these unfavourable factors. The yeast needs a liquid decisively acid to decompose the sugar. If the liquid is not acid the yeast will not attack the sugar, while other wrong bacteria will do so. To a certain extent, the more acid the must the better for the yeast.* The best way to have must with a larger amount of acid is to adopt a longer pruning and to anticipate the time of vintage. I do not mean to adopt a long pruning for a kind of vine which is known to prefer a short one, but to leave, for instance, five spurs when you would leave only four, or rather leave a rod with six or seven buds bent down like a bow with the end tied to the vine stake or stem. But then it is necessary that you should attend to the land more than before as far as labour is concerned. In the meantime you will not have such a high quantity of sugar, nor so high a density of the must. By this way you will be able to produce wine not so full-bodied, but a lighter one more similar to a Claret.

It has been calculated that in a must with only 17 per cent. of sugar, which corresponds to a density of 1,070, some 71,000 *calories* of heat are developed, namely, if the must when it began to ferment had only 75 deg. Fah. of temperature, and if the sugar were all decomposed at once, the must would reach the temperature of 203 deg. of Fah. Of course this never happens, because the sugar is gradually decomposed and the heat meantime developed is partially expelled; consequently the less tumultous will be the fermentation, the more gradually will the heat develop, and thus be easier expelled and not accumulate in the vat. Therefore, we should always bear in mind that the cooler the must is when it begins to ferment, the better, while special fittings should be resorted to for the easier expelling of the heat owing to the decomposition of the sugar attacked by the yeast.

* The yeast of the vinous fermentation is stronger and may better paralyse the bacteria of the lactic fermentation and similar others of pathogen nature if the must has not less than 6 or 7 per mille of fixed acidity; it is weaker in a must poor of acids, and then a temperature of 95 deg. Fah. will prove harmful to it, while it may be harmless to the must more acid.

Small vignerons may pick the grapes early in the morning and squeeze them directly, and suspend the vintage during the hottest hours of the day, while the grapes picked in the afternoon might be left exposed during the night in a ventilated atmosphere.

Grapes in this case should not be heaped up, but placed on a couch on the pavement of a terrace. Vignerons who have large vineyards cannot afford to do this, it being too slow a way of proceeding with the work. Then for them there are special refrigerator machines, one of which is by Duboc. In this system the apparatus is outside the vat, and a great supply of water is not necessary, because you may collect the water once used and use it again.

Another system that has already been applied in this Colony is the use of refrigerator pipes inside the vat; but they have not proved very successful and have already been rejected in Algeria.

A new system is that of injecting cool air into the fermenting must by the means of special bellows. A very common way, and one that you are used to, is placing a wooden pump in the vat, pumping the must and pouring it again on the skins. This system is very similar to that which is called *remontage*, having not only the effect of allowing the must to absorb a cooler air, but also of aerating the must and distributing a uniform temperature, putting all the bulk of the liquid in actual contact with the skins, and taking out of them more colouring matter, tannin, and other extractive substances. Whichever may be the machine or tool that you apply for cooling the must you should first consult the thermometer, and when it marks 90° F. underneath the hulls, then it is time to act. Another way of not allowing a too high temperature, and of expelling the heat, is the use of small cement vats. Wooden ones are not as good to expel heat as the cement ones, for wood is a bad conductor of heat.

All your cement vats I find have no vaults with a door on the top, which should be at least in one or two of them in order that the surface of the liquid should not be exposed to the oxygen of the air when you wish, for instance, to prolong the contact of the wine with the skins so as to have a wine more intensely coloured, or when, for instance, you wish to pass on red grape skins either a pink coloured wine, or a white wine which is only inferior as white, while it might turn a medium red wine on a prolonged contact with good rich coloured skins of Malbec or Shiraz. When the fermentation is declining or finishing, the air comes in contact with the wine, and there is a probability of its turning out acetic. The door on the top of the vault when shut up would compress a certain quantity of carbonic acid inside. For this reason many wooden fermenting vats are built with an upper bottom.

Again, in order to expel the heat produced inside the vat, Captain Tuté, who is a vigneron in Tunis, is suggesting the use of a metallic vat enamelled inside. He also suggests that the contents of the vat should not exceed from 1,200 to 2,400 gallons, to answer both the economical and the technical point of view, and in Algeria the so-called Sidero-cement vats are also found convenient. These Sidero-cement vats consist of a frame of wire netting, enamelled inside and outside with Portland cement.

Once it was maintained that by keeping a low temperature in the cellar you had one of the best ways of having a lower temperature in the fermenting must; but it has been proved that even when the difference between the surrounding ambient of the cellar and the fermenting must was very striking, the latter did not give out much more heat than in the case when the difference between the two temperatures was not so great.

Aeration of the Must.

Does the aeration of the must assist in obtaining a better fermentation? Until a few years ago the aeration of the must before the fermentation began was not questioned, and was admitted for every must and under every climate; but since the experiments of M. Dessoliere have been published the value of aeration in hot countries is contested, and, it is said, may prove of damage; in fact, the aeration, by mixing oxygen with the must, helps the germination of the germs and the budding of the spores of the yeast, so that the ferments become more numerous and crowded in each drop of must, whence the fermentation will set in actively and all at once, developing any amount of heat which is difficult to expel, so that the temperature of 95 deg. Fah. is soon attained, and allowing the more or less strength of sugar and acids, the fermentation checked after a few hours, when a great quantity of saccharine matter is still undecomposed. Again, the aeration of the must during fermentation, when the temperature is about 95 deg. Fah., may prove harmful on account of the bacteria of the lactic acid, which is better assisted at the above temperature by the presence of the air. So that the operation I called *remontage*, in order to cool down the must when too hot, should be done by allowing the end of the hose to touch the surface of the cap, in order that the must may fall in that ambient reach of carbonic acid, standing above the surface of the liquid. In cool climates and with light musts the good of the aeration is not questioned in the least, and the *remontage* of the must at any time during fermentation will prove of great use.

Levures pures.

What is this question of *Levures pures?* I cannot help, before beginning the argument, to point out some general information on the yeast of the vinegrape juice. The agent of the vinous fermentation is a colony of very small organisms called *saccharomyces.* They feed on the sugar, on the nitrogenous substances, and on the mineral salts of the must, and as a compensation for what they eat they expel alcohol, carbonic acid, glycerine, and succinic acid. 100 parts of sugar, according to Pasteur's equation, gives:—

Alcohol	48·36
Carbonic acid	46·56
Glycerine	3·21
Succinic acid...	·61
Cellulose	1·23

48·36 of alcohol, being in weight, represents 61 in volume.

These figures should only be considered as theoretical, because, in common practice, there is always a waste of alcohol on account of evaporation, and absorbtion of this body by the skins and stocks of the grapes. It is understood that for one part of pure alcohol you should take 1·7 of sugar.

If you look through a microscope at a drop of must when it is fermenting, you will see any amount of round or oval-shaped cells, either isolated or like a chain, many of them showing a protuberance like a boss, which is a young cell—say a young ferment in the way of formation that soon will get independent and free from its mother. A man who is not familiar with these things may think that they are all alike, but if you get used to them you will soon see that not only are they of different shape, but that they act in a different way; and at one moment, for instance, when the fermentation is beginning you will see a given ferment in pre-eminence, and at another

moment, when the fermentation is finishing, a new-shaped yeast has overcrowded the first. It is a sort of succession, one race preparing the ambient to the next one.

Fermentation starts with the ***saccharomyces apiculatus*** and ends with the ***saccharomyces ellipsoïdens***. The second fermentation during spring is principally due to the ***saccharomyces pastorianus***. But together with this levures a lot of different wrong bacteria, spores of moulds, &c., hamper the yeast engaging a struggle for life. Moreover, it has been proved that the yeast which is on the skin and on the stock of the grape is not only one race, but that there are different races, each one acting in a way which is particular to it, the difference consisting in a more or less resistance to heat, in the faculty of decomposing more or less sugar in a given length of time, in germinating and budding more or less actively, in a more or less adaptability to one must rather than another, in giving a different percentage of alcohol, carbonic acid, glycerine, or succinic acid for the same quantity of sugar, and for developing a peculiar bouquet which is specific to each race. When they are artificially cultivated in a laboratory in wort or gelatine they show other morphological characters by which each can be recognised; but I pass this over, or else I would go beyond the practical aim of the paper, and I shall only say that by this way it has been proved that the yeast for instance of the Sauterne is not the same as that of the Chablis, that the yeast of the Sherry is not the same as that of the Madeira, and so on. Again, as soon as this has been discovered, it has also been found that each wine had one or more specific races of yeast prevalent during the fermentation of the must, and great importance was attached to them, and it was said the character of the wine depends on the most active races of yeast in each case.

Then you understand the outcome of this discovery. Say they tried to sow the yeast of the most famous wine in the must of a district not so famous. In fact, not only in Government institutions but also in private establishments, they began to cultivate the yeast of the best wines and the latter sell it as the way of producing the best brands in whatever country and with whatever kind of grapes. And now I cannot do without a short criticism, which I daresay is not original, because now this question of *levures pures* at the present time has been stripped of the poetry created in the fervent imagination of those who misunderstood the facts and the results.

I have already pointed out that during fermentation there is an alteration by turns of many races of yeast, each one preparing the ambient to the next one until the former disappears and the second sets in, and at the end of the fermentation the wine will have a character which is the outcome of the mixed influence of these different races of levure. What do the *levures pures* sold at present consist of, and how are they prepared? Now, we take for instance the *levure pure* of the French wine called Château Yquem. As a rule, where these things are prepared they sterilise a small quantity of wort, and then a colony of yeast, coming from only one cell, is sown. The wort then sets in fermentation, and a crowd of pure yeast, coming from that only one cell of Château Yquem is in that wort. This is sold as the *levure pure* of the Château Yquem. But how can we say that the cell of the *levure* formerly sown was from the special race to which the palatable character of the Château Yquem is due? And, in any case, we have seen that different races of yeast set in by turns, each one acting regularly and peculiarly.

Moreover, it is very questionable if the palatable character of the wine is only due to the yeast: experience has shown that the chemical composition of the must is of great importance, say the harmonic proportion between the

different substances of the must which are connected with the soil, the kind of grapes, the climate, etc. Again, why should we import the *levure* of one district into another? this is a striking contradiction to a law of nature, every organism indigenous to a country being the most suitable for that country because it is the consequence of natural selection. Nevertheless, the latter is an argument of a theoretical order, and we may add those of practical experience, which has shown that in many instances there was no difference between wines fermented with *levures pures* of renowned wine-growing countries and those fermented with their own natural yeast.

I remember, two years ago I was engaged in some rather large experiments of this kind at the college where I came from, and our results coincided with those of other countries, namely, the use of *levures pures* may be only considered useful from this point of view: we import in a must in which a struggle for life is going on between the natural yeast and the wrong bacteria and spores of moulds, a crowd of artificial young yeast, already prepared and fit to start the fermentation at once, very active and prolific, which will conquer the field and master it by paralysing the action of the many organisms which would consume the sugar, giving in compensation substances noxious to the palatable character of the wine.

Consequently then, I say, to attain this end it is not necessary to import *levures pures* prepared by any firm, for every vigneron is able to prepare for himself a young pure yeast by choosing the best grapes in his vineyard, squeezing them in a tub all nice and clean, and after from thirty-six to forty-eight hours, when the must is in tumultuous fermentation, pour it in the fermenting vat, where the bulk has already been put in, and stir with a rammer in order to blend the two musts. It would be desirable for a more actual blending to pour the must in fermentation with a bucket while the filling up of the vat with the bulk of the must is on, so as to have a bucket of must in tumultuous fermentation for each couch of the other. One twentieth of the best must in tumultuous fermentation poured in the bulk of it when this has not yet begun to ferment is a fair proportion fully answering to the purpose.

Two Systems of Fermentation.

There are two systems of fermentation. First, fermentation with the marks afloat; second, with the marks submerged. In the first system, namely, with the marks afloat, it is necessary that at least once a day all the must of each vat should be drawn off from the bottom hole of the vat and poured again on the skin for the same reasons that I expressed when I spoke of the *remontage*, and ramming three or four times per day as well, while, when you adopt the second system, say of the marks submerged, by using a false bottom you may spare this trouble unless the vat is too big.

Perhaps you wish to know which I prefer of these two. Well, both are good systems from the technical point of view, and by his special conditions each vigneron must judge whether the first or the second will be more suitable for carrying out the work quickly and completely.

According to the strength of the must in saccharine matter, and more especially of the initial temperature of the must, the fermentation will finish in less or more time. This you will perceive by testing the must with your saccharometer. When you take the sample of must to test, it is suggested that the different couches be stirred and mixed so as to have a standard of

the average density. Before plunging the instrument into the glass vessel you should filter the sample and correct the temperature of the must, bringing it down to 80 degrees F., if you use the Keene's saccharometer, and to 60 degrees F. if you adopt the Baumé's, the Guyot's, or the Babo's.

When the saccharometer marks 0 or 1 per cent. of sugar then it is time to draw off the wine from the vat. But mind you, I have already said that the instruments are often misleading, and sometimes they may mark that the wine is still sweet, while it is not as yet, and *vice versâ.* So that the best way to judge of the right time to draw off the wine from the vat is to taste it, to look at its colour, whether it is enough or not; whether it has enough body, and enough tannin. The palate and the eyes are the best judges on this matter, so that if you are not a good wine-taster you cannot be a good wine-maker. But when you taste a wine that has just then finished the fermentation, you should, when judging, take into account all the changes that it will undergo through time, as far as colour, tannin, acids and all other constituents are concerned. Still you should take into account whether the wine will be sold early or later on, and whether it will be blended or not. At any rate, for a red wine, full colour and full body, even if it is a little rough, there is always a market. Of the little roughness, which is caused by an excess of tannin and colour, it is always easy to get rid, the fining, the blending, and the age will do that, and the wise wine merchant will always prefer a full-bodied wine, which is easier to keep and is always a good base. But the wine must have a clean and neutral taste, and the cleanness of the cellar, of the vats, of the casks, of the instruments, of everything connected with the operations, and the rejection of the rotten grapes, are the best way to secure this. No particular should be neglected, very often the smallest particulars are the most important. When you think that the wine has the amount of colour and body and tannin that you desire, you can then draw it off and bring it into the casks, taking care that they are clean, with a nice vinous smell, and which for more security shall have been washed again and again and thoroughly steamed. Then you may put the tap to the bottom hole of the vat and draw off the wine into a large tub, from which, with a pump, draw the wine into its cask and either a sieve or willow may be suspended under the tap so as to stop seeds and skins, and for the aeration of the wine, which now being at a lower temperature, will not receive any harm, while its colour will revive, through the action of the oxygen on its colouring matter, the latter having been influenced during the fermentation by a phenomena of *reduction*. Again by mixing air to this wine you will revive the yeast, and if some sugar is still undecomposed it will be attacked by the ferments in the cask, so achieving the fermentation, therefore in this instance it is not necessary to burn any sulphur into it.

The marks should be rapidly pressed, or else they may undergo the acetic fermentation. I would have devoted a chapter to the argument of pressing the marks but these notes would be too long and tiresome, so that I postpone giving this information till I shall visit the various vineyards, if any reader should desire these particulars, and I shall only say now that the wine of the first pressure is of the same quality as the bulk, so that it may safely and wholly be blended with it, provided that the pressure has not been pushed too far. Anyhow, as a precaution, you may taste it while it is escaping from the press, and when you find it begins to be too acid, harsh, or inferior, you should separate the first, and collect the last in another vessel. In some places, where people care more for the wine, they press the marks twice or three times, so getting a poor wine, which is joined to the salaries of the labourers. For your information, marks by being pressed may give as an

average half their volume of wine. Then you get the skins relatively dry, which, as far as I know, you care little for, while they are worth a lot. In fact they are still very rich in colouring matter and tannin, which might be used to make a red light wine out of a white one of very little value as a white, by letting it for some days on the said skins in variable proportions.

A solution of young brandy and tartaric acid might be used for extracting the colouring matter and employing this tincture for many uses, and at last marks are rich of alcohol and cream of tartar which you waste, while every year you import thousands of pounds worth of cream of tartar, especially from Italy. I suppose readers do not expect that I should give particulars on these things at present in the limited space available, but later on I shall be glad to do so.

And now I must come back again to consider the wine in the cask. The wine soon after it has been drawn off is still warm, but in cooling, its volume lessens, the rough sediment having settled on the bottom in the first fortnight it is time then to rack and thenceforth fill the casks regularly every week. About the first month of winter, say when the wine on account of the cold weather got rid of some more sediment, rack it again.

The above information is directed to show the capital principles on which the rational making of that category of red wine, which is the basis of the beverage most commonly drunk, is founded, and to give you an idea of the different phenomena of the fermentation. I suppose that now I should deal with the making of white wines, and I try to do so as briefly as possible.

White grapes should be pressed in a press rather than crushed in a mill, as by pressing the grapes, you will have a wine with a more delicate thin yellow colour, as white dry table wines should be. The must should then be collected in a large vessel not very deep, no skins being allowed to ferment, the must stirred and aerated for half an hour, is left quiet, and then a skim will soon form on the surface consisting principally of yeast, germs of fungus, albuminoid substances and impurities. When this skim begins to crack it should be skimmed off, and the must again left to rest for five or six hours, a new film of skim again forming and being taken away. When grapes are from a vineyard which is in a very fertile soil, whether manured with organic manures or lying in a very fertile flat, to skim the must is a capital operation, because then the wine will keep sound longer, will be more delicate, and the finings will be more successful. In some places white musts are skimmed off three times.

Perhaps you would like to know why we do not skim red musts. Red grapes are rich in tannin, and tannin is a great agent for getting rid of the albuminoid substances of the wine, while white wines are very poor of the said tannin, and, unless we take away the greatest part of the albuminoid substances by other means, they would stay in the wine and be the cause of alterations.

The must being skimmed is drawn off and brought in small casks, either hogshead or pipes, leaving an empty space amounting to one-fourth or one-fifth of the contents. Then a bubler should be applied to the bunghole until fermentation is finished.

When the fermentation is finished, the wine should be drawn off and stored in other casks and filled carefully up. After one month and half or two months rack it again.

A few words on the making of Muscat. Muscat wine should always be sweet or else the flavour will turn out in a nasty taste. Muscat should be fermented with the skins, because most of the flavour is in them. To keep a wine sweet you must brandy it, and this should be done during

fermentation, when only one part of the sugar has disappeared, and from 8 per cent. to 9 per cent. of it is still in the wine.

In this case, one day after that fermentation has begun, you should take a sample from the cask and try its density with your saccharometer, and when it marks 8 to 9 per cent. of sugar then you should add to it as much brandy as will raise the strength of the alcohol to 28 per cent. of proof-spirit, which is necessary to check fermentation. Of course, you wish to know how much brandy you ought to add, so as to attain the said alcoholic strength. If you were able by chemical manipulation to test the strength of the alcohol by an alambic, then you would have proceeded in a different way, but this is not in the reach of all, and so I give you the method in the four arithmetical operations.

I will assume that when you have tasted your must of Muscat before it began the fermentation, the saccharine matter contained in it was 24 per cent. I have tested in the Corowa district many musts of Muscat with a saccharine strength much higher than 24 per cent. The above has been given only as a formula of calculation; that is, for every 100 lb. weight of this must, 24 lb. are grape sugar. When twenty-four parts of sugar are transformed, you will have $24 : 1{\cdot}7 = 14$ per cent. of pure alcohol in your wine, equivalent to 24·5 proof-spirit, but, in this case your Muscat would be dry, while you wish to have in it, for instance, eight parts of sugar for every hundred of Muscat. Therefore, out of 24 per cent. only 16 should be allowed to decompose. This 16 per cent. of sugar will give out by fermenting 9·42 parts of pure alcohol, which are equivalent to 16·44 per cent. of proof-spirit, in round numbers 17. These figures being obtained as follows:—

$$16 \div 1{\cdot}7 = 9{\cdot}42$$
$$9{\cdot}42 \div 0{\cdot}5727 = 16{\cdot}44$$

To check fermentation we need at least 28 per cent. proof spirit, so that: $28 - 17 = 11$ gallons of brandy proof strength ought to be added to every 100 gallons of your Muscat to raise its alcoholic strength to 28 per cent.

Some of you may have a brandy which is not proof-spirit, but either over-proof or under-proof. We take, for instance, a brandy 40 over-proof, that means for every 100 gallons of this brandy you would have to add 40 gallons of water to lower its strength to proof-spirit. Then the following equation will give you the number of gallons of this brandy, 40 over-proof to be added, to every 100 gallons of your Muscat to attain the strength of 28 proof-spirit:—

$$100 + 40 : 100 = 11 : x$$
$$x = \frac{100 \times 11}{140} = \frac{5 \times 11}{7} = 7{\cdot}85, \text{ viz.,}$$

in round numbers 8 gallons are necessary for the above purpose. (1)

If your brandy, for instance, is 20 under-proof, this means that you will require for every 80 gallons of it 20 gallons of water to make up 100 gallons of proof-spirit, and then the following is the equation:—

$$100 : 80 = 11 : x$$
$$x = \frac{11 \times 80}{100} = \frac{11 \times 4}{5} = 8{\cdot}8$$

say in round numbers 9 gallons of the brandy 20 under-proof are wanted to

(1.) It is to be remembered that 1·7 part of sugar is in the common practice necessary for 1 part of alcohol, and that 57·27 represents the percentage of pure alcohol of the hydro-alcoholic solution taken as standard by Syke's.

raise the alcoholic strength of your Muscat to 28 per cent. proof-spirit so as to check fermentation. (2).

When at last you have calculated the quantity of brandy that is to be added, then pour it into the cask and afterwards pour the wine on it.

I cannot omit a particular: If you wish that 8 per cent. of sugar should stand in your Muscat, then you should draw it off from the fermenting vat when it marks 10 per cent., so taking into account the difference shown by the common saccharometers owing to the other substances influencing the density of the must, and also considering that during the manipulation of measuring the brandy, drawing off the wine, &c., the fermentation goes ahead, so reducing more sugar. If you are not aware of that, it will happen that instead of 8 only 5 or 6 per cent. of sugar will stand in your Muscat.

(2.) If we call A the number of gallons of a brandy proof-spirit necessary to raise the alcoholic strength from a given percentage to 28, B the number of degrees of a brandy over-proof, and x the wanted number of gallons of it to attain the same strength of 28 per cent. proof-spirit, we shall have

$$100 + B : 100 = A : x$$

$$x = \frac{100 \times A}{100 + B}$$

and if we call B the number of degrees of a brandy under-proof, then we shall have

$$100 : 100 - B = A : x$$

$$x = \frac{(100 - B)\,A}{100}$$

Orchard Notes for April.

G. WATERS.

THE month of April, generally speaking, gives the orchardist a chance to pick up backwork. Most of the stone-fruits have been sent away, only a few late apples, pears, and quinces remaining, which are easily attended to; but do not allow it to cause you to neglect marketing with the care that is necessary.

The above are fruits that need not be rushed into the market, but as many as possible should be stored for the winter months, not only for household and local consumption or sale but also for the Sydney winter and early spring market, when apples of good quality are worth good prices. The prices obtained for apples during this month have been far from satisfactory, and it is mainly due to the fact that the small locally-raised apples are still persistently grown by our orchardists, when there are really splendid varieties that would succeed equally well.

There is no tree easier grafted than the apple, and it is really never too late to graft an apple-tree over again. Mark now the trees that you intend to work over, and see that you get good healthy wood later on when you do the work. A few of the apples that succeed well, and attain good size and store well, are the following:—Gravenstein, Emperor Alexander, Prince Bismarck, Mère de Ménage, Lord Nelson, Granny Smith Seedling, Allsop's Seedling, and Aiken's Seedling; the latter two being also quite blight proof, a very great consideration in our warm coastal districts.

The storing of apples and pears should not entail a great expenditure, and certainly is not difficult; a building that can be maintained at a fairly even temperature being all that is necessary, and in the country can be built at a moderate expense. The walls should be thick enough to prevent sudden changes of the atmosphere inside, and it should also be free from draughts, as these tend to make the fruit stored therein shrivel. It should also be as free from light as possible. If a suitable place is available on the side of a hill that is the place to select. Before building see that provision is made to carry off the water that would accumulate on the back. Good thick slabs make a splendid store-room, covering over the cracks with bark, or some material on the inside to prevent draughts. Bark makes a good roof, but if good water-tight sheets are not available use iron, but first have a covering of bark. They are best stored on shelves all round the shed, about 2 feet apart and 1 foot deep. Before putting into the storing room they should be sweated for a few days, this being easily done by allowing them to remain in the cases they have been picked into.

Too much stress cannot be laid upon the necessity for careful handling, as one bruised fruit will cause many to decay.

The building just described would also be available for the storage of oranges and lemons; but I will deal with these in another month's notes—suffice it is, that if any citrus-grower intends to do some storing this year, now is a good time to build, as work is usually slack this month.

The same applies to any improvements that are intended to be carried out, such as fencing, draining, cleaning out surface drains, or procuring stakes where new orchards are intended to be planted.

Where the latter is intended the land should be got ready as soon as possible. As advised in last month, do the work thoroughly, any extra labour or expense being repaid not only as regards the health of the trees, but also simplifies the after cultivation.

At the first breaking up of new land, or the rebreaking up of old fallow land, it is best to leave it broken up roughly, as a good weathering helps to sweeten it.

All weeds should be kept down, and any insects or fungi requiring attention should be treated. Where pear-mite has made its appearance the resin and soda wash should be used as soon as the leaves commence to fall, as this will kill them before they have a chance to secret themselves for the winter. Cherries and apricots suffering from shot hole fungus should be sprayed with the Bordeaux mixture, using the summer solution, the quantities being 6 lb. copper sulphate (bluestone), 4 lb. caustic lime, and 40 gallons water. The method of mixing has been frequently given in *Agricultural Gazette.*

Peaches and nectarines affected with peach rust should be similarly treated before the leaves fall. After recent rains citrus-trees will be making young growth. When this is stopped keep a look out for scale insects upon them, using the kerosene emulsion when necessary.

Vegetable and Flower Growing.

Directions for the Month of April.

Vegetables.

Asparagus.—Prepare land by trenching and manuring for planting towards the spring.

Beans, Broad.—Sow largely.

Beans, French.—Too late to sow except in the warmest parts of the Colony.

Beet, red and silver.—Thin out seedlings as they come up, and keep the ground clean and well worked between the rows. Too late to sow except on a very small scale.

Borecole or Kale.—Sow a little seed.

Brussels sprouts.—Sow a small quantity of seed. Plant out well-grown seedlings.

Cabbage.—Sow a good quantity of seed. Try varieties—Early Jersey, Wakefield, Early Dwarf York, Succession, and Sugarloaf. Plant out largely.

Cauliflower.—Sow a little seed, and plant out well-grown seedlings on rich land.

Carrot.—Sow largely in drills, about 1 foot apart.

Celery.—Plant out a few seedlings on rich land.

Endive.—Plant out largely.

Leek.—Sow a good quantity of seed, and plant out seedlings largely.

Lettuce.—Sow largely, and plant out well-grown seedlings.

Onion.—Sow a little seed in drills thinly, unless the onions are required for pickling, when the seed should be sown thick.

Parsley.—Sow a little seed.

Peas.—Sow a good quantity of seed.

Radish.—Sow a little seed.

Spinach.—Sow a little seed.

Shallots.—Plant out a few bulbs.

Garlic.—Plant out a few bulbs.

Herbs.—Sow a little seed.

Flowers.

Annuals.—Sow seeds of all kinds of hardy annuals, and protect the seedlings from insects when they come up.

Roses.—Plant out Tea-scented and Hybrid tea-scented varieties.

Bouvardias.—Plant out before the weather becomes too cold.

Carnations.—Plant out.

Bulbs.—Plant out as soon as you can all kinds of Spring flowering bulbs, or else it will be too late. Amongst these are included daffodils, narcissus of all sorts, tulips, crocuses, &c., &c.

Cuttings.—Plant cuttings of roses, fuchsias, verbenas, carnations, and other plants, which it is wished to increase. They should strike most readily now if well looked after and kept moist, but not too wet. They should be shaded from the sun.

General Notes.

Fruit Pulp.

The following reports on Fruit Pulp have been furnished by courtesy of the authorities of the Victorian Department of Agriculture; and, although it is perhaps late in the season to direct attention to this subject, we are certain that fruit-growers who look to this industry as a means of disposing of surplus summer fruits, will appreciate the valuable information Messrs. Sinclair and Knight have been good enough to supply:—

I.

To the Minister of Agriculture.

Suffolk House, 5, Laurence Pountney Hill, Cannon-street,
London, E.C., 2nd October, 1896.

Sir,

I have been making inquiries in reference to fruit pulp imported into England for the purpose of jam making.

The principal sorts imported are apricot, raspberry, and black currant. Apricots come chiefly from the Mediterranean ports of the South of France. They are packed in 10 lb. tins, the fruit not being mashed but cut in halves, the stones being taken out. The price, delivered in London, was stated by one large importing firm to be from £10 to £13 per ton, whilst another one gave present values at from 11s. to 13s. per case ten tins, each containing 10 lb.

Raspberry pulp brings from £19 to £26 per ton, good quality realising £25. A considerable quantity of this pulp has been received from Tasmania. Some of this was sent in 56 lb. tins, with the result that many came to hand burst, the tins being too large. Care must be taken to have all raspberry and black currant pulp absolutely free from leaves and foreign matter. Black currant pulp is imported chiefly from the South of France. It realises from £28 to £32 per ton, and there is stated to be a good demand for it if it can be sold here at from £25 to £28 per ton. There is but little demand for peach pulp, and it is generally regarded as unsaleable. English grown plums as a general rule are plentiful and cheap, their market value for jam making being from £5 to £7 per ton.

I am purchasing a case of assorted pulps, and will forward this by steamer to the Department of Agriculture, in order to show its condition and how it is put up. Its condition on arrival will also show how pulp sent from Victoria will stand carriage across the tropics. The ideal size for tins to contain pulp is stated by all importers to be that which will contain 10 lb.

Yours faithfully,
J. M. SINCLAIR,
Superintendent of Exports for the Victorian Government.

II.

System of Pulping Victorian Fruit.

The system of pulping is similar to that of canning or bottling. The apricots should be halved and stone removed. The half fruits are then steamed or boiled until they are sufficiently scalded to kill all ferment germs, and, whilst hot—not less than 180° Fah.—are soldered up, and the cans subjected to boiling heat for a few minutes until living germs within are destroyed. The process is so simple that with ordinary care no mistake can take place. The tins when completed and cooled down, should be compressed in sides and ends. This is the best indication that the pulping has satisfactorily been completed. When any of the tins show signs of swelling it is a clear proof that there is fermentation within, and it should be looked to at once, and these tins again scalded; but the pulp will not be as good as that which has been properly sterilized at first. It is advisable to preserve the fruit in the form in which it is placed in the tins.

There are various methods adopted in putting up fruits. Some scald them in an open pan, and then fill into cans whilst hot, soldering up at once and again submit them to a boil to kill any stray germs. Others place the raw fruits in the can and solder up the lid, leaving a small vent hole in the top to allow the air to escape. When the contents are sufficiently scalded the vent is closed up and the tins submerged in the boiler for a short time to destroy any germs that might by chance have escaped in the process. Little or no water should be added. As the pulp is usually made into jam, the water or juice of the fruits has to be considerably reduced in the process of pulping, and where there is an excess of water the value of the pulp is lessened. In some cases the cut fruit is placed in a cask with the head out and steam driven through it, the top being covered over. The tins are then filled up from this and soldered down. This is an excellent plan, but the fruit is rather broken by it. Small tins holding about 10 lb. are best, and samples of these may be seen at the Department of Agriculture, Melbourne.

26th December, 1896. J. KNIGHT.

Agricultural and Forestry Museum.

For many years attention has been devoted by the Department to the establishment of a Museum in which might be displayed representative specimens of the agricultural and forestry resources of the Colony. Want of suitable accommodation in some place accessible to the public has retarded this project; but a portion of the old Technological Museum building in the Sydney Domain was secured some time ago, and a fairly comprehensive collection of agricultural products and commercial timbers is now open for inspection. In order that visitors to the Museum, which is open to the public from 10 a.m. till 4 p.m., may obtain any information desired with respect to exhibits, the officer-in-charge, Mr. J. Martin, junr., timber expert to the Department, is in daily attendance. The Minister is anxious to make this Museum as educational and attractive as possible, and has issued instructions for the preparation of pamphlets concerning each set of exhibits. Thus, a visitor desiring to undertake the cultivation of any particular crop represented will be able to obtain in concise form printed directions for every operation.

The following list will afford some idea of the present scope of the collection, and in order to make the Museum as representative as possible, the Department will be glad if those engaged in the farming or timber industries will forward any exhibits which they may think of sufficient educational interest:—

Wheats.

Varieties for Early Sowing.—Blount's Lambrigg, Hudson's Early Purple Straw, White Lammas, White Tuscan, Berthoud Defiance, Farmer's Friend, Grosse's Prolific, Marshall's, Leaks, White Velvet, Sicilian Square-headed Red, Australian Talavera, &c., &c.

Varieties which may be Sown Late.—Allora Spring, Canning Downs, King's Jubilee.

Varieties for Hay.—Defiance, Blount's Lambrigg, Purple Straw, White Lammas, Australian Talavera.

Early Ripening Varieties.—Steinwedel, Velvet Pearl, Early Para, Canning Downs, King's Jubilee, Allora Spring.

Varieties for making Macaroni.—Poland, Belatourka, Medeah.

Varieties for Chick Feed.—Algerian, Mummy. These varieties can be grown on our coast lands.

Rust-resistant Varieties.—Sicilian Square-headed Red, Marshall's, Defiance.

Collection of Pulses suitable for growing in the hot dry districts of the Colony.

Peas.—Collection of field and garden varieties.

Tares.—Golden, Black, Scotch, Algerian.

Cow-pea.—Black, Clay-coloured, White, Whip-Poor-Will, Chinese Red, Black Table. Most valuable for renovating old worn-out wheat lands; a good fodder plant, and also used as a vegetable.

Soy-bean—Pigeon-pea—Mung-bean (black and green)—*Tangier-pea.*—These are some of the pulses which are so highly recommended by vegetarians as being foods which should come into general use in place of meat. The plants of Soy-bean are used in the United States for making into hay, and the celebrated Soy-sauce of Japan is made from the beans. Pigeon-pea is cultivated extensively in India as a fodder plant.

Lima-bean.—Large, dwarf bush. A summer vegetable, used in enormous quantities in the United States.

Miscellaneous collection of Seed.

Peas (10 varieties), hemp, tares (2), sugar-beet (3), salt-bush (4), sorghum and millets (20), oats (20), grasses (50), wheat (60), barley (4), rye (3), buckwheats (3), jute, linseed, maw-seed, rape-seed, clovers (6), tagosaste, spider-plant (for honey), mustard (2), pepper (2), nutmeg, chili (6), cocoa-beans, tea, coffee (2), cotton (4), sugar-corn (4), maize (12).

Rolled-oats, oatmeal, mace, chicory, ginger, pearled barley, general collection of vegetable seeds, &c.

Glass jars showing the various stages in the manufacture of sugar, eight varieties of canes, molasses, treacle, and golden syrup to white spirit.

Among the goods in the cases are over thirty kinds of tobacco leaf for pipe, cigar, and cigarettes, also showing cigars and cigarettes made from it. The cigarettes are pronounced by experts to be equal in quality to the best Egyptian and Turkish kinds.

Ramie—Has succeeded admirably at Lismore. Produces a valuable fibre from which the celebrated China cloth is made. Shown in ribbons and in a beautiful silky-white dressed condition. Likely to prove a valuable crop to our farmers in suitable districts.

Exhibit from the Experiment Farm, Wollongbar, near Lismore, Richmond River.

Pulses (26 varieties), general farm seeds (14 varieties), maize meal (4 varieties), cotton, ramie or Chinese grass-cloth (*canes*), ramie ribbons, banana fibre, tobacco-leaf, safflower (*Carthamus tinctorius*), arrowroot, canaigre root for tanning, chaff (2 kinds), maize (21 exhibits), onions (10 exhibits), pea-nuts (2 kinds), till (*Sesamum indicum*)—from the seeds an oil known as Gingelly oil is obtained; this is said to be equal to olive oil, and is sometimes used for adulterating this oil; the plant grows with great luxuriance at Wollongbar,—castor oil beans, rice, grain, tree tomato, bananas (7 kinds), pine-apple (2 kinds), beans (green, collection), arrowroot tubers, cassava tubers, taro tubers, tumeric tubers, sugar-canes (14 varieties). *Economic Plants*—Rice, ramie, citronella, &c. (8 kinds); fodder plants and grasses (12 kinds), samples of cane from Lawyer Palms, samples of basket made from above.

Wollongbar Experiment Farm is situated in the "Big Scrub," Richmond River district, in the semi-tropical and north-easternmost portion of New South Wales. Although only three years have elapsed since the work here has been started, numbers of useful experiments have been carried on, and great interest is being taken in the work by the settlers in this beautiful and luxuriant district.

Collection of Insect Friends and Foes of Farm, Garden, and Forest.

Wood-borer moths; moths injurious to farm and orchard; sphinx or hawk moths; life-history of the pepper-tree defoliating silk moth; useful carnivorous beetles; defoliating beetles of farm and forest; long-horned wood-borers; beneficial and destructive ladybirds; injurious suctorial insects (plant-bugs, froghoppers, and cicadidae); common scale-insects; crickets, locusts, and grasshoppers; walking-stick insects; wild moths; honey and humble bees; predaceous friendly insects; sugar-cane insects; insect architecture.

Models of apples, pears, peaches, oranges, lemons, cherries, plums, tomatoes, apricots, nectarines, mangels, turnips, &c., in all 700, for purposes of nomenclature.

Collection of timber in logs, planks, and polished, of all the useful trees of the Colony. Some of the timbers for special purposes are noted below.

Bee-boxes—Cedar, beech.
Bending Timbers—Spotted gum, blackwood.
Boat-building—Cedar.
Boat-knees—Prickly tea-tree, white tea-tree and other tea-trees, water-gum, red honeysuckle, white honeysuckle, mangrove.

Boring-rods (for artesian wells)—Spotted gum.
Bridge-decking—Tallow-wood, red mahogany, white mahogany, blackbutt, spotted gum, Murray red gum.
Broom-handles—Rosewood, beech, blue-berry ash, spotted gum, tallow-wood.
Bullock-yokes –River oak, swamp oak, brush box, hickory or black wattle, mangrove, white honeysuckle.
Butter-boxes—Colonial pine.
Butter-kegs—Silky oak, red silky oak.
Carriage-building—Coachwood, red cedar, rosewood, plumwood, beech, brown or bully beech, colonial pine, blackwood and mountain hickory.
Carving—White holly, cheesewood, coachwood, white teak, native orange, scrub hickory, corkwood, long Jack, rosewood, plumwood, black bean, cedar, beech, brown pine, colonial pine, native guava.
Ceilings—Cedar, beech, colonial pine, cypress pine, blue-berry ash, sassafras.
Cobra-resisting timbers—Turpentine, tallow-wood, red mahogany, ironbark, prickly tea-tree, brown pine.
Cog-wheels—Teak, tea-tree.
Cricket-bats—Black pencil cedar.
Dairy utensils—Silky oak, red silky oak.
Doors—Red cedar, pine.
Engraving (bold outlines only)—Cheesewood, native cherry, wild lemon, brush ironbark.
Felloes—Sydney blue gum, grey gum.
Floats of Mill Wheels—Beech, mountain ash.
Flooring—Tallow-wood, beech, colonial pine, sassafras, stringybark.
Fuel—Pine-knots, cypress pine, teak, box, ironbark, she-oak, honeysuckle.
Furniture—Red cedar, rosewood, red bean, onion-wood, black bean, white ash, tulipwood.
Gun-stocks- Cherry, blackwood, mountain hickory, coachwood, maiden's blush.
Handles (axe)—Spotted gum, mountain ash, water gum.
Handles (tool)—Blackwood, pigeon-berry ash, native cherry, brush-box, water gum, swamp oak, grey box, spotted gum.
House-blocks (Wooden piers or piles)—Rosewood, cypress pine, grey gum, Murray red gum, forest red gum, red mahogany, ironbark.
Mallets—Water gum, brush-box, pigeon-berry, plumwood, tulipwood, mangrove.
Mauls—Swamp oak, grey box, water gum.
Naves—Rosewood, red bean, apple, spotted gum, ironbark, grey box.
Oars—Blue-berry ash.
Paving—Tallow-wood, blackbutt, mahogany, blue gum, grey gum, white mahogany, spotted gum, Murray red gum, bloodwood, turpentine.
Piano-frames—Black bean, red bean, rosewood.
Picture-frames—Beech, blue-berry ash, white honeysuckle, blackwood.
Piles—Turpentine, brown pine.
Pipes (tobacco)--Needlewood, myall.
Planes—Brush-box, plumwood, blackwood.
Posts—Ironbark, red box, white mahogany, tallow-wood, red gum, grey gum, red mahogany, bloodwood, turpentine.
Railway Keys—Cedar, flindosa.
Railway Sleepers—Ironbark, grey gum, Murray red gum.
Railway Waggon-building—Ironbark, grey box, tallow-wood, blackbutt.
Screws—Rosewood, swamp oak, water gum, plumwood, native cherry, grey box.
Jaws of Screws—Brush-box.
Shafts and Poles—Spotted gum, mountain ash, ironbark, grey box, blackwood, mountain hickory.
Sheaves and Blocks—Water gum, beech, blackwood, mountain hickory.
Shingles—Forest oak, grey gum, red mahogany.
Spokes—Apple-tree, ironbark, spotted gum, blackbutt.
Staves (for casks)—Silky oak, red silky oak, black wattle, silver wattle, mountain hickory, white ash, blackwood, red ash, ironwood, blue-berry ash, rosewood, coachwood.
Swingle-trees—Ironbark, mountain ash, spotted gum, blue or flooded gum.
Tram-rails—Brush box (north coast), spotted gum (south coast).
Turnery—Forest oak, rosewood, blackwood, black bean, tulip.
Vats—Beech.
Veneers—She-oak, tulip, figured black bean, musk, honeysuckle, red silky oak.
Walking Sticks—Blackwood, white honeysuckle, forest oak, tulip, cabbage palm.
Weatherboards—Tallow-wood, red mahogany.
Well-slabs—Teak.

White-ant resisting Timbers—Cypress pine, brown pine, red mahogany.

Wine-casks—White ash, blackbutt, beech, silky oak, rosewood, silver wattle, black wattle.

Wire-mattress Frames—Colonial pine, rosewood.

Exhibition of Hardwoods—Some sections of railway sleepers, paving blocks, and piles, which have been in use for years. It will be instructive to many visitors to see sections of eucalyptus timber—solid and unworn almost—after forty years in the sea, or twenty-five years on a railway line, or thirteen years in a busy city street.

Very few people have any idea of the beauty of the native timbers when worked up. Not only are there specimens, which enable the visitors to see the bulk of the trees and great slabs, many feet across, cut from forest giants, but also in the show cases a number of specimens of workmanship may be observed. Amongst these are chessmen—the black from myall and the white from black apple—walking sticks, pipes from needlewood and myall, balusters of twelve different kinds of timbers, &c.

Collection of seed and seed-vessels, and herbarium specimens of almost all the timber and shrubs in the Colony, kinos, gums, resins, sandarach of the gums, wattles, grass-trees, pines, &c.; also barks for tanning purposes.

Leaves of *Duboisia myoporoides* from which is extracted an alkaloid known as Duboisine. This alkaloid is used in cases of ophthalmia, &c.

The Bathurst Experiment Farm.

Arrangements have been completed for the admission of students for instruction in the practical operations of farming at this place. For the accommodation of the students and staff commodious buildings have been rented in the vicinity of the farm. Advantage will also be taken of the accommodation available in "Logenbrae"—the rented premises—to establish laboratories in which the scientific staff of the Department may conduct investigations and experiments in connection with work now in progress at Wagga Farm and Hawkesbury Agricultural College.

Replies to requests for Information.

With the object of affording readers of the *Agricultural Gazette* an opportunity of bringing under notice matters which they consider should receive attention in our pages, a circular was a short time ago addressed to all recipients of the publication. We are pleased to acknowledge the receipt of numerous requests for special information and many suggestions as to the subjects of future articles. The forms are coming in daily, and in the meantime arrangements are being made to publish, as speedily as space will permit, replies to the questions that readers have submitted. As far as possible, the matters will be dealt with in order of their urgency.

An effort will be made to render the publication of replies to questions of general interest a feature of the *Gazette*, and it is hoped readers will continue to co-operate with the Department in leaving no stone unturned to advance the commercial interests of the agricultural community.

AGRICULTURAL SOCIETIES' SHOWS, 1897.

Society.	Secretary.	Date.
Dapto A. and H. Society ...	A. B. Chippindall	Jan. 6, 7
Albion Park A. and H. Association	H. Fryer	,, 13, 14
Gosford A. and H. Association	W. McIntyre	,, 29, 30
Wollongong A. and H. Society	J. A. Beatson	Feb. 3, 4
Cobargo A., P., and H. Society	T. Kennedy	,, 16, 17
Ulladulla P. and A. Society	C. A. Cork	,, 16, 17
Berrigan A. and H. Society	R. Drummond	,, 17
Riverina P. and A. Society (Cereal)	W. Elliott	,, ——
Manning R. (Taree) A. and H. Association	H. Plummer	,, 18, 19
Lithgow A., H., and P. Society	J. Asher	,, 18, 19
Robertson Agricultural Society	R. J. Ferguson	Mar. 2, 3
Bega A., P., and H. Society	J. Underhill	,, 3, 4
Southern New England (Uralla) P. and A. Association	Jas. Leece	,, 9, 10
Tumbarumba P. and A. Society	W. Willans	,, 9, 10
Tenterfield Intercolonial P., A., and M. Society	F. W. Hoskin	,, 10, 11, 12
Coonabarabran P. and A. Association	E. May-Steers	,, 11
Oberon A., H., and P. Association	A. Gale	,, 11, 12
Berrima District (Moss Vale) A. H. and I Society	J. Yeo	,, 11, 12, 13
Cobargo A., P., and H. Society	T. Kennedy	,, 16, 17
Crookwell P. and A. Association	W. P. Levey	,, 18, 19
Lismore A. and I. Society	T. M. Hewitt	,, 18, 19
Walcha P. and A.	F. Townsend	,, 23, 24
Cudal A. and P. Society	C. Schramme	,, 24, 25
Blayney A. and P. Association	J. Clements	April 1, 2
Mudgee A. P. H. and I. Association	J. Cox	,, 6, 7
Liverpool Plains (Tamworth) P., A., & H. Association	A. M'Leod	,, 6, 7, 8
Warialda P. and A. Association	W. B. Geddes	,, 7, 8
Williams River A. and H. Association	W. Bennett	,, 7, 8
Cooma P. and A. Society	D. C. Pearson	,, 7, 8
Orange A. and P. Association	W. Tanner	,, 7, 8, 9
Gulgong P. and A. Association	C. E. Hilton	,, 13, 14
Royal Agricultural Society	F. Webster	,, 14–20
Moree P. and A. Society	S. L. Cohen	,, 21, 22
Hunter River (West Maitland) A. and H. Association	W. C. Quinton	,, 28, 29, 30
Hay Hortic. Society	J. Johnston	May 5
Namoi P. and A. Association (Narrabri)	J. Riddle	,, 5, 6
Hawkesbury District Agricul. Association (Richmond)	C S. Guest	,, 6, 7, 8
Upper Manning A. and H. Society	W. Dimond	,, 12, 13
Wellington P. & A. Society	R. Porter	,, 13, 14
Upper Hunter P. and A. (Muswellbrook)	J. C. Luscombe	,, 19, 20, 21
Gunnedah P. A. and H. Association	J. H. King	Aug. 3, 4.
Grenfell P. and A. Association	Geo. Cousins	,, 25, 26

Northern Agricultural Association	... C. Poppenhagen	Sept.	1, 2
Murrumbidgee P. and A. Association (Wagga)...	... P. W. Lorimer..	,,	1, 2
Albury and Border P. A. and H. Society ...	... Geo. E. Mackay	,,	8, 9
Junee P. and A. Association	... J. C. Humpreys	,,	15, 16
Berry Agricultural Association	... A. J. Colley ...	Nov.	25, 26

Secretaries of Societies are asked to forward dates of forthcoming Shows as soon as decided.

[8 plates.]

Value of the Phosphate of Lime in Bone-dust.

By F. B. GUTHRIE.

In 1889 Professor Wagner, of Darmstadt, conducted a number of careful experiments into the fertilising value of different phosphatic fertilisers.

These experiments were carried out by means of the pot system, first introduced by him and brought to a state of great perfection, and led to the surprising conclusion that the phosphoric acid in the ordinary raw bone-meal was so low in fertilising value when compared with the phosphoric acid in superphosphate or Thomas slag, as to be almost worthless.

His results may be thus summarised:

The following tabulated results, both of these and of subsequent experiments of Professor Märcker, are taken partly from the original memoirs, and partly from an excellent *resumé* of this work published last year in the form of a bulletin by Dr. Wellington, of the Hatch Experiment Station, Amherst, Massachusetts.

Rye, manured with the same amount of phosphoric acid, in the form of superphosphate, basic slag, and bone-meal respectively, yielded for every 100 lb. of crop obtained by the use of superphosphate 59 lb. crop when basic slag was used, and 8 lb. only when bone-meal was used as a fertiliser.

A second experiment in clay soil showed that for every 100 lb. of crop obtained by the use of superphosphate, only 5 lb. were obtained when the same amount of phosphoric acid was added in the form of bone-meal.

At the same time the alleged superiority of the after-effects of bone-meal received a shock, for it was found that when the same manuring was continued a second year in the same soil, the yield of the crop manured by bone-meal was in the proportion of 15 lb. to every 100 obtained where superphosphate was used.

In the third year the yield of the plot fertilised by bone-meal was 17 per cent. of that obtained by superphosphate.

These experiments show that although the after effect of the use of bone-dust is to increase the yield of this particular crop, yet the results fall very far short of those obtained by the use of superphosphate.

The experiments in this and all other cases were carried out by the pot system already referred to. The pots received the necessary manuring, other than phosphates, by the addition of carbonate of lime, sulphate of potash, chloride of potassium, sulphate of magnesia, and ammonium nitrate. Except for the phosphates which were under experiment, each pot received precisely the same treatment.

The pot system has been shown to give results exactly similar to treatment in the open field in all other cases, and there is no reason to believe that it is likely to be unfavourable in the case of bone-meal.

As a result of these experiments the Association of Bone-meal Manufacturers of Saxony appealed to Professor Märcker, of Halle, to investigate the question thoroughly.

Professor Märcker's experiments extend over a period of four years, and embrace different varieties of soil and crops, and different brands of bone-dust, both raw and steamed and glue-free, representing the best qualities of bone-meal on the market.

The first set of experiments were carried out with barley in sandy soil. The following are the results summarised:—

1. ·6 grms. phosphoric acid, in the form of superphosphate, yielded 101·56 grms. grain and straw. The same amount of phosphoric acid, in the form of bone-meal, yielded only 5·96 grms.
2. 1·5 grms. phosphoric acid, in the form of superphosphate, yielded 114·38 grms. crop, as against 12·18 grms. obtained by the use of the same amount of phosphoric acid in bone-meal.

Put in another way, the amount of phosphoric acid furnished to the plant by superphosphate and bone-meal, is in the ratio of 4·6 from the bone-meal to every 100 from the superphosphate in the first case, and 5·2 to every 100 in the second.

It appears also from these experiments, that the phosphoric acid in raw bone-meal, and in steamed and glue-free bone-meal, is nearly equal in value.

The next set of experiments was instituted to ascertain whether bone-dust produced more beneficial results when applied in conjuction with superphosphate.

The following are the results. The crop grown was barley on a sandy soil:—

Phosphoric acid employed.		Increase of yield over unmanured pots.	Increase due to bone-meal.
Amount.	Form.		
·6	Superphosphate	167·29	....
·3 ·3	Superphosphate Bone-meal	90·97	7·32
·3 ·9	Superphosphate Bone-meal	104·67	21·02
·3 1·5	Superphosphate Bone-meal	105·91	22·26
·6 ·6	Superphosphate Bone-meal	152·74	Nil.
·6 1·2	Superphosphate Bone-meal	156·05	Nil.

These experiments show that there is no advantage in mixing bone-dust with superphosphate, and that the increase of yield is practically due only to the superphosphate. The soils in which the previous experiments had been conducted were sandy soils, which are usually regarded as being particularly benefited by the application of bone-dust.

The use of bone-meal is generally especially recommended on account of its reputed after-effects, its application being supposed to permanently enrich the land.

In order to test this question, oats were sown in 1894 in the pots in which wheat had been grown in the previous year. The necessary nitrogenous manuring was applied, but no phosphates. The following table shows the results obtained:—

Phosphoric Acid originally added.		Increase of yield in Oats (Second Year).
Amount.	Form.	
·6	Superphosphate...	14·74
·6	Raw bone-meal	12·36
·6	Glue-free bone-meal	16·14
1·2	Superphosphate...	43·41
1·2	Raw bone-meal	13·58
1·2	Glue-free bone-meal	22·34
1·8	Superphosphate...	65·57
1·8	Raw bone-meal	35·40
1·8	Glue-free bone-meal	26·11

On examining the above table, it will be noticed that the smallest quantity of superphosphate did not show any striking effects in the second year. This is to be expected, since the greater portion of the available phosphoric acid had been already used up by the wheat-crop of the previous year.

Those pots, on the contrary, which had received a larger quantity of superphosphate in the first year, showed considerable after-effect, which, though not as high as in the first year, was, nevertheless, very considerably higher than the after-effect of bone-meal.

In order to test the after-effects of bone-meal still further, a crop of mustard was grown in the same pots from which the oats had been harvested for the above experiments, nitrogenous manure being added, but no further phosphates. The results are as follows:—

Phosphoric Acid originally added.		Increase in Third Crop (Mustard) over Unmanured Pots.
Amount.	Form.	
·6	Superphosphate	+ 52·9
·6	Raw bone-meal	— 0·3
·6	Glue-free bone-meal	+ 34·2
1·2	Superphosphate	+173·9
1·2	Raw bone-meal	— 4·9
1·2	Glue-free bone-meal	+ 15·2
1·8	Superphosphate	+196·9
1·8	Raw bone-meal	+ 85·2
1·8	Glue-free bone-meal	+ 33·9

Here the after-effects of bone-meal, as compared with superphosphate, are still less favourable.

Another series of experiments similar to those previously quoted shows that the after-effects of bone-meal are not increased when it is used in conjuncton with superphosphates. Whatever the proportions in which bone-meal and superphosphate were mixed, the increase in the yield of oats (as second crop) due to bone-meal was practically nil.

The results of the experiments above quoted show that, at all events, for sandy soils, poor in phosphoric acid, which are exactly the soils supposed to be benefited by the application of bone-dust, the action of the phosphoric acid in bone-dust does not approach the action of the soluble phosphoric acid in superphosphate, whether the bone-dust is used alone or mixed with superphosphate, or whether in respect to the immediate results or the after-effects.

The next series of experiments were undertaken on different classes of soils, relatively rich in phosphoric acid, having been used in previous years for bone-meal experiments.

The soils used include sandy soils, loam, humous loam, clay loam, sandy loam, humous sand, &c., &c. The crop raised was oats.

The mean of all these experiments is as follows:—Increase in yield over unmanured plots was 79·99 when superphosphate was used, as against 5·10 when the same amount of phosphoric acid was applied in the form of bone-meal.

As before, a crop of mustard was grown after the oats to test the after-effect of bone-dust in these soils.

The mean of all the results show that the increase in the yield over the unmanured pot was 28·3 in the case of superphosphate, as against 5·2 in the case of bone-meal.

As Professor Märcker says, the previous experiments would have a very unwelcome result, if it were not possible to treat bone-meal in a cheap way so as to make it more effective, and this can be done by the addition of a small quantity of sulphuric acid, not enough to convert the bone-phosphate into superphosphate, but just sufficient to convert it into the bi-calcium phosphate, a form of phosphate which, though insoluble in water, is readily available by the plants and has a fertilising value only little inferior to that of superphosphate itself.

This can be done by adding to every 100 lb. of raw bone-meal, 20 lb. sulphuric acid of 60 degrees strength (Baumé), or 40 lb. to every 100 of glue-free bone-dust.

It is advisable that the bone-meal should not be in too fine a powder, but in a coarse state about the size of peas. These proportions give a little more acid than is enough to convert the bone-phosphate into bi-calcium phosphate, and are the most effective.

The following experiments show the action of these products upon a crop of barley, in a sandy soil poor in phosphoric acid.

Phosphoric Acid applied.		Increase of yield of Barley over unmanured.
Amount.	Form.	
·6	Superphosphate...	167·29
·6	Prepared raw bone-meal	128·71
·6	Prepared glue-free bone-meal...	160·29
1·2	Superphosphate...	204·44
1·2	Prepared raw bone-meal	184·02
1·2	Prepared glue-free bone-meal...	180·42
1·8	Superphosphate...	202·40
1·8	Prepared raw bone-meal	200·65
1·8	Prepared glue-free bone-meal...	207·50

In order to test the after effects, oats were grown as a second crop, and the following results were obtained, the necessary nitrogen being added as in previous similar experiments, but no further phosphates :—

Phosphoric Acid applied. Amount.	Phosphoric Acid applied. Form.	Increase in yield of second crop (Oats) over unmanured.
·6	Superphosphate...	14·74
·6	Prepared raw bone-meal	16·06
·6	Prepared glue-free bone-meal	12·80
1·2	Superphosphate...	43·41
1·2	Prepared raw bone-meal	30·67
1·2	Prepared glue-free bone-meal	40·13
1·8	Superphosphate...	65·03
1·8	Prepared raw bone-meal	42·99
1·8	Prepared glue-free bone-meal	75·04

The effect upon the third crop was as follows :—

Phosphoric Acid applied. Amount.	Phosphoric Acid applied. Form.	Increase in yield of third crop (Mustard) over unmanured.
·6	Superphosphate...	52·9
·6	Prepared raw bone-meal	121·2
·6	Prepared glue-free bone-meal	103·7
1·2	Superphosphate...	173·9
1·2	Prepared raw bone-meal	151·2
1·2	Prepared glue-free bone-meal	117·9
1·8	Superphosphate...	196·9
1·8	Prepared raw bone-meal	206·2
1·8	Prepared glue-free bone-meal	175·7

It will be seen from these experiments that the fertilising value of the prepared bone-meal is almost equal to that of superphosphate.

In the words of Professor Märcker, " One may twist and turn the matter as one will, whether used with cereals or crucifers, in sand, clay, or loams rich or poor in phosphoric acid, in cold or hot years, whether in respect to its effects upon the first or upon succeeding crops, the result is always the same, namely, the action of the phosphoric acid in bone-meal whether raw or steamed or glue-free, is invariably unsatisfactory, and the author comes

to the conclusion that it is high time that raw, steamed, and glue-free bone-dusts should cease to be regarded as phosphatic fertilisers; they require previous treatment just as the mineral phosphates do, in order to make effective fertilisers of them, and the author believes that the future of the bone-meal industry lies in the preparation of these products which the experiments here recorded have shown to be effective."

It is therefore clear from the above that the beneficial action of bone-meal is not due to the phosphoric acid, but to the nitrogen which it contains. Professor Märcker is now engaged in a series of experiments, with the object of ascertaining more exactly the nature of this action. Experiments on oats in light sandy soil gave the following results:—

Nitrogen applied.		Increase over unmanured.
Amount.	Form.	
1·05	Raw bone-meal	85·24
1·05	Steamed bone-meal	100·53
1·05	Nitrate of soda	124·94
2·10	Raw bone-meal	127·31
2·10	Steamed bone-meal	129·52
2·10	Nitrate of soda	158·63

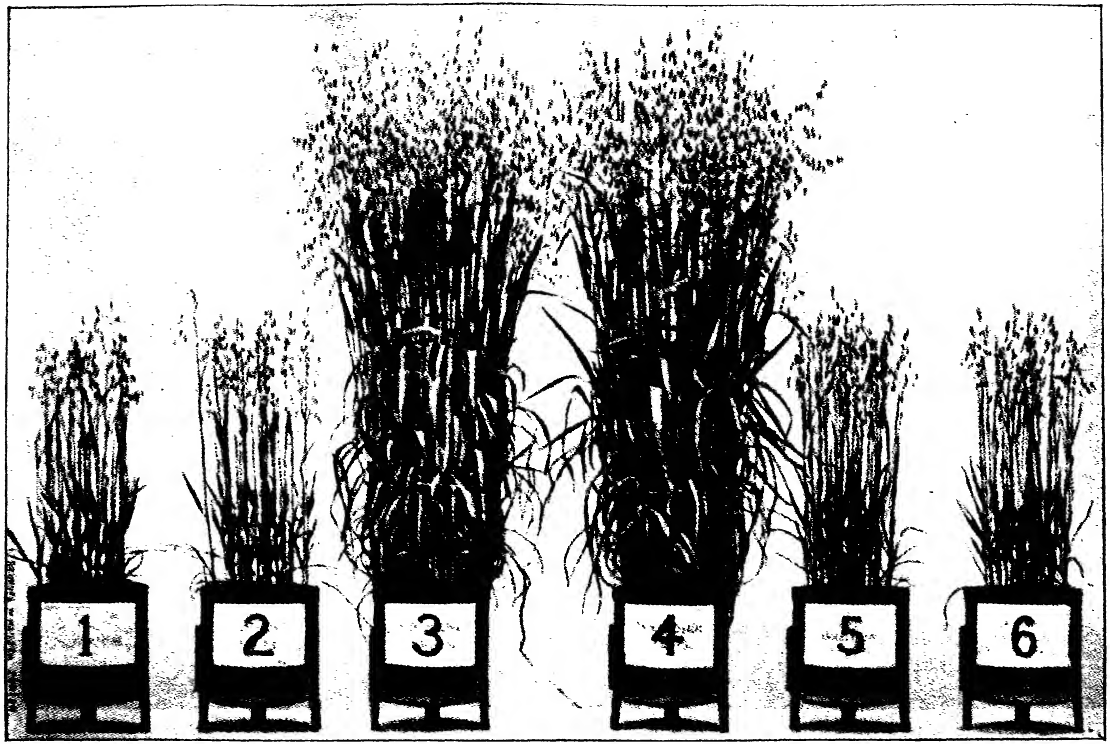
The following results were obtained with barley on a light humous loam:—

Nitrogen applied.		Increase over unmanured.
Amonnt.	Form.	
·75	Raw bone-meal	33·22
·75	Steamed bone-meal	31·30
·75	Nitrate of soda	59·96
1·50	Raw bone-meal	68·83
1·50	Steamed bone-meal	90·91
1·50	Nitrate of soda	124·59

The effect of the nitrogen in bone-meal was 70 to 80 per cent. of that produced by nitrate of soda in sandy soil, and from 55 to 70 per cent. in humous loam.

These experiments into the officacy of the nitrogen in bone-meal are now being continued by Professor Märcker.

The following gives in a tabulated form the results of an independent series of experiments by Dr. Liechti and Dr. Vogt, of the University of Bern, Switzerland, in 1896. The experiments were carried out by the method of pot-culture adopted by Professors Wagner and Märcker, and had especially the object of testing the efficacy of a raw mineral phosphate (phosphorite). The experiment goes to substantiate the results previously



TO ILLUSTRATE EXPERIMENTS OF DR. LIECHTI (reproduced from *Landwirtsch Jahrbuch der Schweiz*, Vol. X, 1896).

1. Without phosphoric acid.
2. 1·0 grm. phosphorite.
3. 0·35 grms. superphosphate.
4. 0·35 grms. basic slag (Thomas phosphate).
5. 0·35 raw bone-meal.
6. 0·35 glue-free bone-meal.

quoted as obtained by Professors Wagner and Märcker, and I reproduce also a photograph which shows the actual appearance of the crops grown under the different conditions.

The soil used was a meadow soil, poor in phosphoric acid, which had never received any manuring whatever. The crop experimented on was oats, previously tested for their germinating capacity. The same quantities of potash and nitrogenous manures were given in each case, and the pots treated with phosphates as below :—

Phosphoric Acid applied.		Weight of crop (Oats), grain, and straw.
Amount.	Form.	
0	....	14·3
·35	Superphosphate	167·0
1·0	,, ...	325·9
·35	Basic slag	171·5
1·0	,, ...	318·4
1·0	Phosphorite	15·1
4·21	,, ...	14·0
·35	Raw bone-meal	15·9
1·0	,, ...	18·4
·35	Glue-free bone-meal (fine)	16·6
·35	,, ,, (coarse)	16·0

Summary.

The results of the experiments above described can be thus briefly summarized :—

1. The fertilizing value of raw, ground, steamed, and other forms of undissolved bone-meal is due solely to the nitrogen they contain.
2. As a phosphate fertiliser it is of very low value, whether used alone or in conjunction with superphosphate, on loams or sandy soils, on soils rich or poor in phosphoric acid, whether with grain or cruciferous crops (turnips, mustard, &c.), either in respect to the first or succeeding crops.
3. The beneficial after-effects of bone-meal have been much exaggerated.
4. The best form in which to apply bone-meal is as "dissolved bone-meal," *i.e.*, mixed with 60 degrees (Baumé) sulphuric acid, at the rate of 20 per. cent. for raw, and 40 per cent. for glue-free bone-meal.
5. Dissolved bone-meal prepared as above is very little inferior to superphosphate, both in its immediate and in its after effects; it is consequently better adapted than superphosphate for stocking land with a supply of phosphoric acid.

The Wheat Harvest of New South Wales.

By THE GOVERNMENT STATISTICIAN.

COMPARATIVE STATEMENT of Total Area Cultivated, and the Area and Yield of Wheat for the Years 1895–6 and 1896–7.

Districts.	Total Area Cultivated.			Total Area under Wheat for Grain and Hay.			Total Area under Wheat for Grain only.			Yield of Wheat.			Average Yield per Acre.	
	1895-6.	1896-7.	Increase.	1895-6.	1896-7.	Increase.	1895-6.	1896-7.	Increase.	1895-6.	1896-7.	Increase.	1895-6.	1896-7.
	acres.	acres.	acres.	acres.	acres.	acres.	acres.	acres.	acres.	bushels.	bushels.	bushels.	bushels.	bushels.
North Coast	144,575	149,946	5,371	1,034	1,336	302	985	1,286	301	10,813	19,351	8,538	11·0	15·0
Central Coast	103,538	114,796	11,258	2,385	4,490	2,105	1,443	3,151	1,708	8,937	45,758	36,821	6·2	14·5
Southern Coast	40,870	53,410	12,540	1,408	1,896	488	485	1,147	662	1,621	16,909	15,288	3·3	14·7
Total, Coast	288,983	318,152	29,169	4,827	7,722	2,895	2,913	5,584	2,671	21,371	82,018	60,647	7·3	14·6
Northern Table-land	90,439	111,497	21,058	41,383	58,239	16,856	36,031	55,256	19,225	369,239	800,446	431,207	10·2	14·5
Central ,, ...	237,149	286,310	49,161	131,054	180,131	49,077	86,074	149,589	63,515	691,947	1,632,461	940,514	8·0	10·9
Southern ,, ...	251,000	308,902	57,902	168,860	219,269	50,409	131,256	195,411	64,155	845,614	1,849,415	1,003,801	6·4	9·5
Total, Table-lands	578,588	706,709	128,121	341,297	457,639	116,342	253,361	400,256	146,895	1,906,800	4,282,322	2,375,522	7·5	10·7
North-western Slope	19,624	25,069	5,445	10,694	15,342	4,648	7,506	11,176	3,670	73,356	138,396	65,040	9·8	12·4
Central-western ,, ...	27,758	41,182	13,424	23,148	35,779	12,631	13,698	19,283	5,585	92,945	125,229	32,284	6·8	6·5
South-western ,, ...	420,810	546,002	125,192	377,321	493,502	116,181	318,110	429,690	111,580	3,096,175	4,213,010	1,116,835	9·7	9·3
Total, Western Slopes ..	468,192	612,253	144,061	411,163	544,623	133,460	339,314	460,149	120,835	3,262,476	4,476,635	1,214,159	9·6	9·7
Western Plains	12,837	18,676	5,839	12,011	17,455	5,444	1,096	1,556	460	4,665	6,856	2,191	4·3	4·4
Total, New South Wales ..	1,348,600	1,655,790	307,190	769,298	1,027,439	258,141	596,684	867,545	270,861	5,195,312	8,847,831	3,652,519	8·7	10·2

I. Coast Districts.

Return showing the total area cultivated, the area under wheat for grain and hay, and the yield of wheat and average per acre, in the counties of the Coastal Districts, for the year ended 31st March, 1897.

Counties.	Total Area Cultivated.	Area under Wheat—		Yield of Wheat.	Average Yield per Acre.
		For Grain.	For Hay.		
	acres.	acres.	acres.	bushels.	bushels.
Northern Coast—					
Rous	33,564	......	6	....	......
Richmond	8,695	38	10	720	18·9
Clarence	35,877	4	2	64	16·0
Fitzroy	4,929	......	2	....	......
Raleigh	11,552	......	......	....	......
Dudley	13,262	.....	......	....	......
Macquarie	27,940	362	26	6,799	18·7
Gloucester	14,127	882	4	11,768	13·3
Total	149,946	1,286	50	19,351	15·0
Central Coast—					
Durham	23,644	1,148	256	17,945	15·6
Hunter	3,417	147	30	1,916	13·0
Northumberland	28,175	1,675	312	22,564	13·5
Cook	12,920	95	137	1,646	17·3
Cumberland	46,640	86	604	1,687	19·6
Total	114,796	3,151	1,339	45,758	14·5
South Coast—					
Camden	29,457	50	155	712	14·2
St. Vincent	11,289	954	471	12,845	13·5
Dampier	4,734	57	66	1,004	17·6
Auckland	7,930	86	57	2,348	27·3
Total	53,410	1,147	749	16,909	14·7
Total, Coastal Districts ...	318,152	5,584	2,138	82,018	14·6

II. Table-Lands.

RETURN showing the total area cultivated, the area under wheat for grain and hay, and the yield of wheat and average per acre, in the counties of the Table-lands for the year ended 31st March, 1897.

Counties.	Total Area Cultivated.	Area under Wheat— For Grain.	Area under Wheat— For Hay.	Yield of Wheat.	Average Yield per Acre.
	acres.	acres.	acres.	bushels.	bushels.
NORTHERN TABLE-LAND:—					
Parry	14,381	9,295	99	156,765	16·8
Buckland	10,877	7,246	882	100,161	13·8
Vernon	2,787	843	13	16,426	19·5
Inglis	6,500	4,634	17	49,451	......
Darling	16,320	13,573	482	132,029	9·7
Sandon	16,697	4,080	547	59,925	14·7
Clarke	1,780	228	21	6,134	27·7
Hardinge	4,935	1,491	227	29,004	19·4
Clive	6,583	2,272	20	36,538	16·0
Hawes	223	10	......	100	10·0
Gresham	156	......	......	....	......
Gough	21,231	6,613	476	120,878	18·3
Arrawatta	8,176	4,928	187	92,029	18·7
Drake	352	......	1	....	......
Buller	499	43	11	1,006	23·3
Total	111,497	55,256	2,983	800,446	14·5
CENTRAL TABLE-LAND:—					
Brisbane	8,418	2,873	396	32,464	11·3
Phillip	14,274	6,737	448	81,541	12·1
Bligh	6,409	3,816	573	35,543	9·3
Lincoln	27,095	14,089	9,646	131,066	9·3
Gordon	24,459	16,812	3,788	134,031	8·0
Wellington	20,675	8,614	1,854	105,195	12·2
Roxburgh	24,259	10,361	677	119,625	11·5
Ashburnham	58,691	36,301	9,269	351,431	9·7
Bathurst	91,203	48,617	3,874	618,684	12·7
Westmoreland	10,827	1,369	17	22,881	16·7
Total	286,310	149,589	30,542	1,632,461	10·4
SOUTHERN TABLE-LAND—					
Forbes	21,607	16,579	3,099	162,925	9·9
Monteagle	46,147	37,550	1,983	350,820	9·3
Harden	52,965	38,977	4,888	341,528	8·8
King	15,713	8,111	263	82,636	10·2
Georgiana	6,747	2,033	58	26,447	13·0
Argyle	15,306	3,415	205	49,513	14·4
Murray	12,485	5,867	240	59,183	10·1
Cowley	1,007	337	22	3,908	11·6
Buccleuch	6,267	2,181	35	36,060	16·5
Clarendon	72,432	53,101	7,675	407,939	7·7
Wynyard	22,992	10,355	2,968	132,038	12·7
Goulburn	20,596	14,228	2,224	159,654	11·2
Selwyn	2,295	260	86	3,110	12·0
Wallace...	3,880	970	53	11,201	11·5
Beresford	4,257	666	20	8,812	13·2
Wellesley	4,206	781	39	13,641	17·5
Total	308,902	195,411	23,858	1,849,415	9·5
Total, Table-lands ...	706,709	400,256	57,383	4,282,322	10·7

III. Western Slopes.

RETURN showing the total area cultivated, the area under wheat for grain and hay, the yield of wheat, and average per acre, in the counties of the Western Slopes for the year ended 31st March, 1897.

Counties.	Total Area Cultivated.	Area under Wheat— For Grain.	Area under Wheat— For Hay.	Yield of Wheat.	Average Yield per Acre.
NORTH-WESTERN SLOPE—	acres.	acres.	acres.	bushels.	bushels.
Stapylton	46	.....	21	....	......
Burnett	2,100	1,346	......	15,677	......
Courallie	693	3	110	60	20·0
Benarba	59	......	15	....	......
Murchison	8,735	4,950	736	72,593	14·7
Nandewar	3,669	1,152	1,017	4,267	3·7
Jamison	404	30	155	200	6·6
Denham	39	......	19	....	......
Leichhardt	756	143	412	2,182	15·2
Barradine	840	370	278	4,848	13·1
White	303	59	86	340	5·7
Pottinger	3,137	1,007	540	11,361	11·3
Napier	1,125	656	143	7,969	12·1
Gowen	3,163	1,460	634	18,899	12·9
Total	25,069	11,176	4,166	138,396	12·4
CENTRAL WESTERN SLOPE—					
Gregory	236	......	180	....	......
Ewenmar	2,030	228	1,246	1,876	8·2
Canbelego	1,197	624	524	5,680	9·1
Oxley	1,259	253	811	1,088	4·3
Narromine	17,128	5,173	8,870	39,943	7·7
Flinders	2,323	1,558	688	10,910	7·0
Kennedy	6,591	4,154	2,080	30,351	7·3
Cunningham	10,418	7,293	2,097	35,381	4·8
Total	41,182	19,283	16,496	125,229	6·5
SOUTH-WESTERN SLOPE—					
Dowling	800	65	706	332	5·0
Gipps	5,382	1,772	2,779	4,240	2·4
Bland	46,081	36,243	5,848	258,139	7·1
Bourke	83,728	66,560	7,835	480,853	7·2
Cooper	16,841	12,944	3,179	91,530	7·1
Nicholson	14,746	10,799	3,822	76,747	7·1
Sturt	2,958	1,982	898	10,935	5·5
Waradgery	3,804	842	2,699	6,332	7·5
Boyd	4,318	3,409	727	37,730	11·1
Mitchell	33,679	26,383	4,135	253,334	9·6
Urana	33,535	24,322	6,111	233,209	9·6
Townsend	18,034	11,776	4,887	129,481	11·0
Wakool	8,762	3,403	4,044	17,067	5·0
Cadell	25,664	22,059	3,452	121,118	5·4
Denison	138,249	126,195	7,898	1,569,954	12·4
Hume	109,421	80,936	4,792	922,009	11·4
Total	546,002	429,690	63,812	4,213,010	9·8
Total Western Slopes	612,253	460,149	84,474	4,476,635	9·7

IV.—Western Plains.

ALL COUNTIES	18,676	1,556	15,899	6,856	4·4

Letters on the Diseases of Plants.

(With nearly One Hundred Illustrations.*)

By N. A. COBB.

THE following notes are compiled from some of my official letters written during the last six months, in answer to inquiries directed to the Department of Agriculture from various parts of Australia. Though most of them relate to pests found doing damage to crops, a number are miscellaneous.

I. WHEAT AND MAIZE, AND SOME OF THEIR DISEASES.

No inquiries are more numerous than those relating to wheat, outnumbering any others as they do in the ratio of four or five to one. Most of these inquiries are concerning the names and qualities of samples of wheat. No doubt this is due to the fact that the shortage in the last two Australian crops has caused the importation of large quantities of wheat from Canada and California. Having used such wheat for seed, and thus secured novel varieties, growers have sent samples by the score. In a number of cases these samples have been unsatisfactory for reasons that I wish to explain in full, so that correspondents may in future be a little more considerate.

The naming of a variety of wheat from a sample is, even under the best conditions, a task that few will undertake. The reason for this is, that the number of known varieties is very great,—how great may be best judged from the following list of wheats now growing in the Nomenclature Plots of this Department located at Wagga and Bathurst:—

LIST of VARIETIES of WHEAT arranged in Groups :—

I. Durum and Poulard Group.

1 Egyptian E.
2 Sicilian Baart.
3 Forella.
4 Mica.
5 Medeah.
6 Egyptian C 1.
7 ,, C 2.
8 ,, D.
9 ,, A 1.
10 ,, A 2.
11 Young's Bearded.
12 Paros.
13 Atlanti.
14 Banater.
15 Cretan.
16 Belotourka.
17 Missogen.
18 Bearded Club.
19 Pugh's R. R.
20 Salvator.
21 Hebron.
22 Hunter's White.
23 Algerian.
24 White-eared Mummy.
25 Brown-eared Mummy.
26 Egyptian B.
27 ,, F.
28 Australian Poulard.
29 Bancroft.
30 Egyptian H.
31 Laidley.

II. Poland Group.

32 Poland.

III. Amidonnier Group.

33 Blue Heron.

IV. Bailey Group.

34 Bailey.

V. Rieti or Ladoga Group.

35 Roberts.
36 Rural New Yorker Rye Wheat Hybrid.
37 Diche Mediterranean.
38 Ladoga.

* Most of the illustrations were prepared by the author, and all were produced under his immediate direction. Figures 13, 14, 15, 16, 17, 18, 39, 40, 41, 42, 43, 44, 45, 46, 49, 50, 51, 52, 53, and 54 were drawn on the wood by the author. Figures 1, 11, 12, 19, 23, 26, 28, 29, 34, and 38 are the author's photographs. Of the remaining figures, Nos. 2, 4, 5, 7, 20, 21, 22, 24, 25, 30, 31, 32, 33, 35, 36, 37, 47, 56, 57, 58, and 59 were prepared by Mr. E. M. Grosse; Nos. 3, 6, and 8 by Mr. W. E. Chambers (who did all the engraving); No. 55 by Mr. F. C. Wills; and No. 46 by Mrs. N. A. Cobb.

39 Hindustan.
40 Tasmanian Red.
41 Lehigh.
42 Brogan's Red and White.
43 Gharaf.
44 Anglo-Australian.
45 Ironclad.
46 Rieti.
47 Ultuna Red Beard.
48 Bearded Red Autumn.
49 Champlain.

VI. Australian Bearded Group.

50 Australian Bearded, Port Germain.

VII. Japanese Group.

51 F1.
52 Early Japanese.

VIII. Bearded Hérisson Group.

53 Sherman.
54 Bearded Hérisson.

IX. Winter Nigger Group.

55 Winter Nigger.
56 Rudy.
57 Bearded Champion.

X. Lazistan Group.

58 Lazistan.
59 Reliable.
60 Penguin Island.
61 Pringle's No. 5.
62 Russian (Shelton's).
63 Frumente Ferrareuse.
64 Bearded Monarch.
65 Thuiss.
66 Deitz.
67 Fulcaster.
68 Miami Valley.
69 New Red Wonder.
70 Crate.
71 Jaspar.
72 Saratow.
73 Rio Grande.
74 Mediterranean.
75 Australian Amber.
76 Soft Portugese.
77 Darblay's Hungarian.
78 Andriola Amber.
79 Barbu à Gros Grain.
80 China Tea.

XI. Beal Group.

81 Beal.

XII. Early Baart Group.

82 Early Baart.
83 Dutoits.
84 Quartz.
85 Early Bearded (French).
86 African.
87 Archer's Prolific.
88 Johnson.
89 Democrat.
90 Champlain Hybrid.
91 Uncle Tommy.
92 Soft Algerian.
93 Californian Genesee.
94 Tall Bearded Neapolitan.
95 Cythere White.

XIII. Bearded Indian Group.

96 Canning Downs.
97 Gore's Indian No. 2.
98 ,, No. 1.
99 Indian Club.

XIV. Bearded Velvet Group.

100 Bearded Velvet.
101 Andros.
102 Pride of Butte.
103 Cone Rivet.

XV. White Velvet Group.

104 Velvet Chaff Red Grain.
105 Old French Velvet.
106 White Velvet.
107 Carter's 87.
108 ,, F.
109 Tardent's Blue.
110 Carter's D.
111 Canadian Velvet Chaff.
112 Brigg's R. R.
113 Jones' Winter Fife.
114 Velvet New Zealand.
115 Basalt.
116 Langfeldt's.

XVI. Velvet Pearl Group.

117 Velvet Pearl.
118 Indian Fife.
119 Carter's 43.
120 Rye Wheat.

XVII. Indian Group.

121 Indian Early.
122 ,, Delta.
123 ,, Zeta.
124 Carter's 81.
125 Early Para.
126 King's Jubilee.

XVIII. Steinwedel Group.

127 Pride of Barossa.
128 Steinwedel.

XIX. Purple Straw Group.

129 Rattling Jack.
130 Fountain.
131 The Blount.
132 Northern Champion.
133 Italian Tuscan Purple Straw.
134 Farmer's Friend.
135 Fillbag.
136 Rattling Tom.
137 Red Straw.
138 Hudson's Early Purple Straw.
139 Jacinth.
140 Australian Glory.
141 Steer's Early Purple Straw.

XX. Tuscan Group.

142 Battlefield.
143 White Tuscan.
144 Frame's Early.
145 Red Tuscan.
146 Purple Straw Tuscan.
147 Californian Chili.
148 Oakshott's Champion.
149 Blue Stem.
150 District.
151 Agate.
152 American Purple Straw.
153 Carter's E.
154 Carter's B.

XXI. Lammas Group.

155 Bordier.
156 Hunter's White.
157 White Tuscan of Lake Bathurst.
158 White Naples.
159 White Flanders.
160 Chiddam.
161 White Lammas.
162 Landreth's Hard Winter.
163 Green Mountain.
164 Dallas.
165 Leak's R. R.
166 White Lammas (from Young).
167 Australian Talavera.
168 Snowball.
169 Talavera de Bellevue.
170 Zealand.
171 Mammoth.
172 Carter's 103.
173 Pringle's Vermont.
174 Propé.
175 Chrysolite.

XXII. Essex Group.

176 Port McDonald.
177 White Essex.
178 Tuscan Essex.
179 Frampton.
180 Chiddam's White Spring
181 Martin's Amber.
182 Soft Algerian.
183 Gneiss.

XXIII. White Club Group.

184 Schilf.
185 Fort Collins.
186 Oregon Big White Club.
187 Hedgerow.
188 Little Club.

XXIV. Noé Group.

189 Zimmerman.
190 Sardius.
191 Summer Club.
192 High Grade.
193 Manitoba.
194 Long Berry.
195 Prince Edward Island.
196 German Beardless March.
197 Mouton.
198 China Spring.
199 Buckby's R.R.
200 Blount's Fife.
201 Urtoba.
202 Pictet.
203 Red Nott.
204 Blount's R.R.
205 Fultz.
206 Noé.
207 Crépi.
208 Bladette Paylaureuse.
209 Saumur de Mars.
210 North Carolina.
211 Autumn Saumur.

XXV. Fife Group.

212 Small's O.K.
213 Anderson's R.R.
214 King's R.R.
215 Niagara.
216 Sorrel.
217 White Chaff Red.
218 Improved Rice.
219 Scotch Red.
220 Russian.
221 Ontario Wonder.
222 Smooth Red Spring.
223 Saskatchewan Fife.
224 Scotch Fife.
225 Finley.
226 Inglis' R.R.
227 Count Waldersdorff.
228 Nimitybelle.
229 Canada Club.
230 Carter's B.
231 Amethyst.
232 Gallician Saumur.
233 Dominion.
234 Red Lorrain.
235 Sardonyx.
236 Kaiser.
237 Sapphire.
238 Indian Gamma.
239 ,, D.

240 Webb's Challenge.
241 Eclipse.
242 Hornblende.
243 Jock.
244 Porcelain.
245 Trap.
246 Ruby.
247 Wright's R.R.
248 Feldspar.
249 White Russian.
250 White Fife.
251 Adamant.
252 Fluorspar.
253 Improved Fife.

XXVI. Defiance Group.

254 Clark's R.R.
255 Beryl.
256 Pringle's No. 5.
257 Australian R.R.
258 Thomas' R.R.
259 Leak's Defiance.
260 Pringle's Defiance.
261 Russian.
262 Pearl or Velvet.
263 Murray River.
564 Defiance.
265 Bega.
266 1 A1
267 Little Wonder.
268 Inglis' Success.
269 Blount's Lambrigg.

XXVII. Golden Drop Group.

270 Trump.
271 Carter's K.
272 ,, H.
273 ,, 107.
274 Pringle's No. 6.
275 Opal.
276 Hallett's Pedigree.
277 Goldsmith's Pedigree.
278 Carter's New Hybrid.
279 Golden Drop.

XXVIII. Square Head Group.

280 Berseler's Club.
281 Scholey's Square Head.
282 Bestehorn's Dividend.
283 Emerald.
284 Red Altkirche.
285 Majorica carusa.
286 Webb's King Red.
287 Carter's A.
288 ,, C.
289 Dwarf Humboldt's.
290 Blé à épi carré.
291 Red Chaff Square Head.
292 Sicilian Square Headed Red.
293 Four-rowed Sheriff.
294 Rimpan.
295 Carter's G.
296 Mould's Red.

XXIX. Allora Spring Group.

297 Clubbed Indian.
298 Indian Alpha.
299 Budd's Early.
300 Allora Spring.
301 Odessa sans barbes.

XXX. Ward's Prolific Group.

302 Golden Prolific.
393 Australian Wonder.
304 Marshall's No. 3.
305 Marshall's No. 8.
306 ,, No. 10.
307 ,, No. 2.
308 Ward's Prolific.
309 Hercules.
310 Red Clawson.
311 Ward's White.
312 Marshall's No. 5.
313 Rousselin.
314 Robins R.R.
315 Currell.

XXXI. Red Provence Group.

316 Odessa.
317 Red Bordeaux.
318 Pool.
319 Clawson.
320 Prince Albert.
321 Red Province.
322 Willett's.
323 Spaulding's Prolific.
324 Banham's Browick.
325 Red Russian.
326 M'Ghee's White.

XXXII. Rural New Yorker Group.

327 Rural New Yorker.

XXXIII. Rye Wheat Group.

328 German Emperor.
329 Rye Wheat.
330 Early Genesee.
331 Stewart.
332 Rye Wheat (for grain).

Miscellaneous.

333 Tuscan Island.

When the reader has examined the foregoing list, he will very likely wonder at its length, and no doubt ask, "Is it possible that there are so many distinct varieties of wheat?" To which the ready answer is, "Yes, it is true; there are more than three hundred varieties of wheat." I do not mean to imply that every name in the foregoing list represents a distinct variety, for it is beyond question that a number of these so-called varieties, especially in the Purple Straw, Lammas, Fife, and Defiance groups, are identical. These are kept in our plots only out of deference to well-known popular names.

One moment more and we will return to the subject of naming wheats. I only wish, first, to explain the nature of the nomenclature plots, which have now become such an established institution. Rows of wheat, each row containing only a single sort, are sown side by side in the order given in the above list. Each row is plainly labelled, and all the wheats of a kind (that is, closely related to each other) are gathered together into a plot, as shown in the adjacent illustration, Fig. 1, and the plot is labelled by means of a large sign bearing the name of the group or family.

These wheats are the result of six years of careful study and selection. They have been chosen from over 1,000 samples obtained from all parts of the world—Australia, New Zealand, United States, Great Britain, Russia, India, Japan, China, South Africa, Italy, Spain, France, Germany, Hungary, Turkey, Algiers, Mexico, Chili, and Canada. The whole world has been drawn upon for these samples.

Hundreds of farmers visit these plots annually, and are invariably found ready to admit their value in educating the community up to a better knowledge of the names of varieties of wheat. These plots and the stud-plots mentioned on a later page have arisen out of my investigation into the

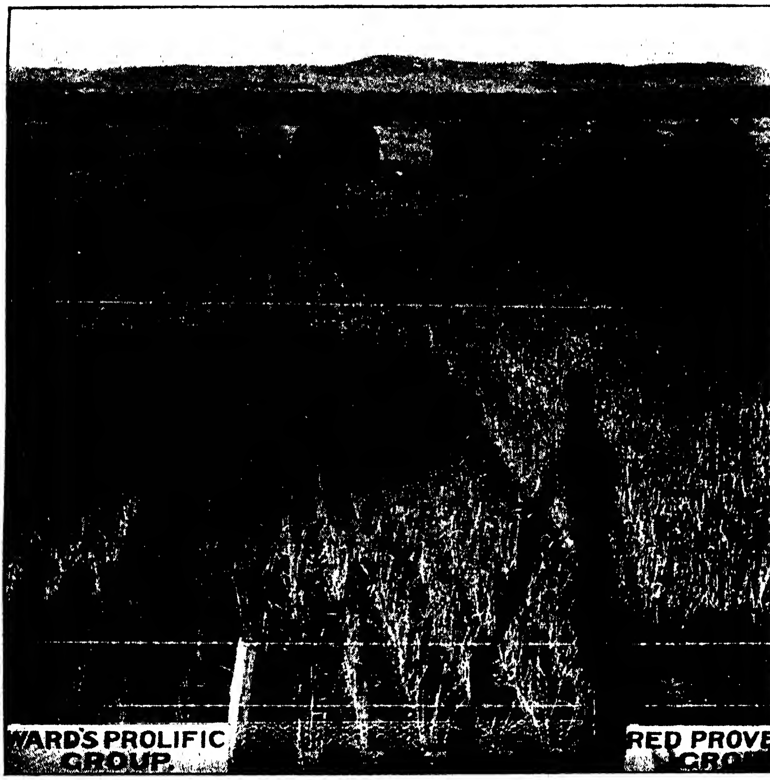


Fig. 1.—Photograph of a small portion of the nomenclature plot as planted at the Wagga and the Bathurst Experiment Farms. Each row of wheat is of a different sort, its name being painted on a 3-inch by 5-inch metal sign placed at the end of the row. These small signs may be seen through the wire netting. These varieties of wheat, each consisting of a single row, are gathered into groups. Nearly the whole of the varieties, fourteen in number, belonging to the Ward's Prolific Group (see page 210) are shown in the picture. Nearly the whole of the Red Provence Group (see page 210) is also shown. The groups are separated from each other by paths. The stacks at the back are a portion of the 1896 seed-wheat—each stack a different sort. The extensive paddocks this side of the far-distant trees are among those on which seed wheat is raised.

disease known as wheat-rust, and are but part of the machinery being created to cope with that disease, though this fact will, probably, for some years yet to come, fail to be fully appreciated.

Now, as to the naming of samples of wheat. Is it any wonder, when the number of varieties is so great, that even experts shrink from committing themselves as to the name of a wheat, unless they have the best of samples and all the information that is available? Those who bring or send samples of wheat to be named should, if possible, provide a *full-grown ripe stool or plant.* In addition, they should give all the information they possess, such as answers to the following questions:—

1. Is the variety early, mid-season, or late?
2. Where did it come from originally—*i.e.*, what is its history?
3. What names have you heard applied to it?
4. Where was the specimen grown, and on what kind of soil?
5. Is the specimen well grown, or have you reason to suppose it to be smaller or larger than usual?

The answers to these and similar questions are always of assistance in determining the name of the variety. To some it may seem a trivial matter, this naming of wheats. Stop one moment and consider the magnitude of the operations in wheat, and then think what a difference it makes whether one variety is a trifle better than another for a given locality or purpose. There you have the reason for these numerous inquiries concerning the names of wheat. Each variety has its particular qualities which suit it to particular purposes, and this is the explanation of the large number of varieties, and of the fact that as many as fifty varieties are grown on an extensive scale.

1. Velvet Pearl.

Of these numerous varieties of wheat none have this season excited greater interest than those which have been recently imported from the United States. I observe that the variety that has excited the greatest amount of interest and curiosity is that variously known as Velvet Pearl, Red Californian, Californian March, &c. Of these various names the one to be preferred is Velvet Pearl. This variety may be described as follows:—It is of medium height, and has a rather shiny, yellow, fine, semi-solid straw, possessing all the good qualities in a medium degree. When ripening the straw is yellow, never purple. The sheath of the upper leaf is less than half as long as the distance from the uppermost joint to the ear. The ears are red and velvety, and this together with the bright yellow straw, gives the plants a particularly bright and attractive look. The ears are beardless, of medium length, very regular, compact, somewhat tapering, square, erect or leaning, straight, or slightly curved, acute at the tip, abrupt at the base, where there are two or three sterile spikelets. The fertile spikelets are spread out wide like an open fan, and contain three or four grains.

Fig. 2.—Ear of Velvet Pearl, one-third full size. Grains full size.

The dull and streaky chaff is of medium length, acute and short-awned throughout the length of the ear, rather deep, roundbacked, of medium

stiffness, but rather loosely attached and not lying close to the grain, so that shelling is likely to occur unless the harvesting is well-timed and careful. The grain is very small, short, very plump, opaque, whitish, flat-bosomed, blunt at both ends, with a shallow close crease and a comparatively abundant brush. A back-crease sometimes is visible. When cut with a knife the interior of the grain shows up very floury. The germ-sculpture is large—that is, two-fifths as long as the grain.

Velvet Pearl is a very early wheat, giving a grain of very good milling quality from the Australian point of view, but it is only a fairly good yielder, as it stools rather sparingly in an upright manner. It will stand a dry climate, in fact seems particularly suited to such. Although the stools are small, this is easily compensated for by thicker sowing. The bulk of seed per acre is about the same as for other varieties, the seed being small. The wheats of which this is an example seem to have come into favour in but few parts of the world. The variety known as Red Californian, with velvet chaff, appears to be identical with the present; both resemble Allora Spring, but the latter has not velvet chaff. New Zealand Velvet appears to be the same as Velvet Pearl. A wheat known as Mexican or Red Mexican is identical with this. Velvet Pearl is early—early enough, perhaps, to be called rust-escaping. It is identical with Blé de Mars de Californie of France. A considerable quantity of it is grown in South Australia.

Fig. 3.—Grain of Velvet Pearl, average form and size.

Prominent characteristics.—Medium height, short, bald, velvety, red heads, smallish white grain of only fairly good quality, very early, fairly good yielder, liable to shell.

Velvet Pearl is, it appears, extensively grown in California and Mexico, and was imported largely last year from the former place to make up the local deficiency, and thus naturally found its way into cultivation. As a milling sort it cannot be said to stand very high. It is early and fairly prolific, but has a rather weak straw, and is very liable to rust. It is, however, well adapted to a hot dry climate, where there are winter rains, and does fairly well on very indifferent soil. The grain is attractive looking. If sown early it may be sown thinly, but if sown late,—and it is a variety that may be sown somewhat late,—it should be sown thickly, at least a bushel to the acre if broadcast, as although its grains are small, and therefore many to the bushel, the plants are not inclined to tiller much.

Although, therefore, a considerable quantity of Velvet Pearl was, perforce, grown this last season, I *would not advise a wide adoption of the variety.* The Allora Spring is much better as an early variety, and is little if any inferior in its milling qualities, and it is a variety whose popularity is growing, especially for late sowing, the demand for seed being recently very active.

2. Chili or Oregon Club.

Another variety recently inported from California for milling purposes, and sold also as seed wheat, is Chili, or Oregon Big White Club.

There are several varieties agreeing essentially one with another grown under these names in the United States. Although they have been introduced into European countries they have not there come into favour, one reason being the poor yield of straw, which in Europe is a valuable product. This factor would not be so important in this country; therefore these sorts

may yet find a place among our cereals. At present they are not much in use. The specimens from which the present description is drawn are tall and have heads of medium length. The straw is yellow, dull in lustre, coarsely furrowed, very hollow, of medium thickness, stiff, and rather brittle. The smooth, yellow, straight, erect heads are bald, of medium length or rather short, very regular, compact or even crowded at the tip, clubbed, flat, blunt at both ends, and present four or five sterile spikelets at the base. The spreading fertile spikelets contain three grains each. The chaff is of medium length, acute, with bent mucrons, short-awned towards the tip of the ear, rather stiff, dull in lustre and uniform in colour, deep, almost angular-backed, firmly attached, and lies close enough to the grain to prevent much shelling. The grain is of medium size and length, straight, almost hump-backed, plump, opaque, yellowish, plump-bosomed, blunt at the tip, rather blunt at the base, and has an abundant brush, a rather deep crease, and a floury cross-section. A back-crease is rarely visible. The germ-sculpture is one-third as long as the grain.

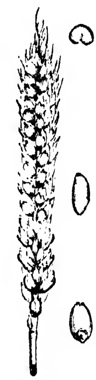


Fig. 4.—Ear of Oregon Club or Chili, one-third full size. Grains full size.

This is a prolific mid-season variety, subject to rust, and one that must be sown early. There are short-eared and long-eared strains of this variety.

3. Rattling Jack.

A third variety, concerning which there has been considerable inquiry, is Rattling Jack, otherwise known as Grosse's Prolific. (See plate at end of this article.) This variety is a first-rate sort for the stripper, its even growth making it possible to take off all the heads without choking the machine with straw. It has most of the qualities, good as well as bad, of the Purple Straw wheats, but is more inclined than they to shell. This is an old and well-known sort, which, however, has of late years gone somewhat out of favour. It is quite short and stiff, and grows a dense stool.* The straw is stiff and strong, of medium and rather uniform thickness, very hollow, only fairly tough, distinctly furrowed, and purplish in colour. The sheath of the upper leaf reaches considerably more than halfway from the last joint of the ear. The foliage is abundant, light-coloured, and drooping. The bald, smooth, straight, erect, regular, short, rosy ears are clubbed, quite crowded, flattened, blunt at the tip, tapering at the base, where there are three or four sterile spikelets. The three-grained spreading spikelets are supplied with chaff of medium length. In the lower part of the ear the chaff is bluntly mucronate, but at the tip of the ear there are several rather long awns. The crowding together of the spikelets tends to prevent shelling, though some shelling does occur. The grains are very large, of medium length, straight, of medium plumpness, opaque, yellowish, rather flat-bosomed, blunt at both ends, especially the

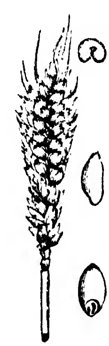


Fig. 5.—Ear of Rattling Jack, one-third size. Grains full size.

* See the four centre rows in Fig. 19.

tip, with a very abundant brush, a rather deep crease, and a germ-sculpture occupying not more than one-third their length. A back-crease is rarely visible. The interior of the grain is rather floury.

Fig. 6.—Grain of Rattling Jack, average form and size.

Rattling Jack may be called an abbreviated purple-straw wheat. Except in form it completely resembles the purple straws, being delicate, and very liable to rust, but a great yielder in a good season, and on good, well-cultivated land. Though the ears are short, they contain a surprising amount of grain. This wheat will stand gales without breaking down. The grain is of good milling quality, from the Australian point of view.

Prominent characteristics.—Rather short, strong stiff purple straw, short bald club-shaped ears, large yellow grain of good quality, rather early, productive, rust-liable, somewhat liable to shell.

4. Fife Wheats.

The only other wheat that requires particular mention is that sent under various names, such as Duluth, Manitoba. These samples, of which only the grain is sent, belong to the group of wheats very generally known under the name of Fifes. The samples sent have invariably been small-grained and red, and as the above names indicate, came from Canada or the north-western part of the United States. The Sydney millers have found that these wheats produce excellent flour when ground in their mills, and now express themselves as ready to pay the full market price for such wheats if grown locally. This result is precisely in accordance with the results of Mr. Guthrie's analyses, made from Australian samples grown by Mr. Wm. Farrer at Queanbeyan, in this colony. From what I have seen during five years of experiment on these varieties at Wagga, I would not advise their trial in the Riverina. In only one season out of four have they done well at Wagga. In all the other years these varieties have presented a poor appearance. On the other hand, in the colder parts of the Colony, they may do well. Mr. Farrer has for many years grown good samples at Queanbeyan. They should do well in New England and about Orange, and in similar places having a cold winter and late spring.

These wheats are commonly called hard, but this is a mistake, at least in so far as calling them hard implies that they are either harder to mill, or harder in the proper sense of that word, than the average run of Australian varieties. The trial of these varieties should be widely encouraged in our colder districts, for the reason that they are prolific, hardy, and, above all, because they produce a flour of superior value as food. Rightly speaking, therefore, the millers should hold them at a premium. It should not be forgotten that these Fife wheats are late wheats; they should, therefore, be sown early. The following is a description of a typical American wheat of the Fife family:—

Fultz.—A rather tall free-stooling wheat, not far removed from the Fife type, not yet grown to any extent in this country. The foliage is rather abundant and somewhat glaucous. The straw is whitish-yellow in colour, stiff, strong, above medium height and thickness, rather tough, hollow, furrowed, and lustrous. The stalk when ripening is usually green, rarely almost imperceptibly purple. The sheath of the upper leaf is long, reaching more than half-way to the ear. The heads are bald, yellow, smooth—that is, not velvety,—rather long, regular, open, tapering, straight, erect, and have

Fig. 11.—Photograph designed to show the method of conducting experiments at the Wagga Experiment Farm. In this portion of the experiment area each row represents a "plot," and is compared only with the row which stands next to it. These particular rows are principal varieties of wheat, such as Talavera, Purple Straw, Allora Spring, &c., being compared with each other over a series of years as to relative yield of straw and grain. The stacks in the distance to the left are various sorts of seed-wheat, each of which of course has to be stacked by itself. The house on the right is a Government farm-employee's cottage. The plots conducted on the row system extend as far as the other house in the distance, and again about half as far in the other direction, *i.e.*, behind the spectator. For the convenience of the visitors the plots are arranged alongside a road, which leads by both the houses shown in the photograph. Nearly all the landscape in the far distance is composed of wheat paddocks.

from two to three sterile spikelets at base. The fertile spikelets are three-grained and spreading. The chaff is uniform in colour, not too firmly attached, and holds the grain only fairly well, deep, close-lying, long, acutish, short-awned towards tip of the ear, stiff, and has a dull appearance. The grain is amber-coloured or reddish, quite small, straight, opaque, rather flat-bosomed, and blunt at both ends; it has an abundant brush. A back-crease is barely visible; when cut across with a knife the section usually appears horny.

Fultz is a well-known latish variety, somewhat above medium height. The best strains of it are prolific, and yield a grain considered in America to be of very good milling quality. It is highly resistant to rust. Manitoba and Russian resemble this variety in type.

Prominent characteristics.—Rather tall, strong, whitish-yellow straw, bald yellow heads, grain of medium size, considered in America to be of very good milling quality, somewhat late, prolific, not liable to shell, highly resistant to rust.

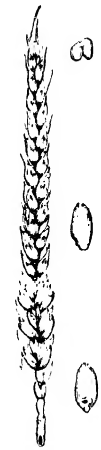


Fig. 7.—Ear of Fultz, one-third full size. Grains full size.

While on this subject it may not be amiss to extract from my letters a few notes on the experiment wheat plots at the Wagga Experiment Farm. As explained in a recent number of this journal* the Wagga experiments are carried out partly on the row system, and the nature of the system is shown admirably in some recently taken photographs which are here inserted. (Figs. 11, 12, and 19.)

Grains of Three Sorts of Wheat for Comparison of Form, Size, and Colour.

Fig. 8.—Grain of Fultz, average form and size.

Fig. 9.—Grain of Rattling Jack, average form and size.

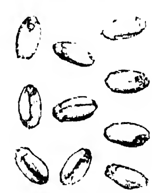


Fig. 10. Grain of Velvet Pearl, average form and size.

Fig. 11 is of a typical plot, designed to show the difference in yield from seeds of various sizes. The left-hand stooks are from large seed, the next from medium sized seed, the next from small seed. These are from a series of several hundred experiments extending over three years. The results will be published in a few months, and will be far more interesting and useful than those of any other experiments hitherto conducted at Wagga with wheat. Fig. 12 shows the manure experiments. Various manures are used in the double rank-growing drills. The intervening three are without manure. These are from a series of over 200 experiments. This is the third year. The results will be ready for publication next year.

There are so many inquiries for a rust-proof wheat and for a "pickle" that will cure rust that I take this occasion to repeat that there is no such thing known as a wheat that is proof against rust. Some varieties resist rust to a considerable degree, and a few in a marked degree, but none of them are proof against the disease.

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* Article on Agricultural Experiment Work.

As for curing rust by treating the seed, the idea is ridiculous. It would be just as reasonable to expect to prevent measles among mankind by soaking babies in some sort of pickle. Rust is a disease that attacks wheat after it is above ground. So far as is known the seed is almost never attacked. In this respect rust differs radically from bunt. Bunt does attack the seed—the seed particularly. This is the reason that various solutions applied to the seed will prevent bunt.

Fig. 13.—Spray of flax attacked by rust, natural size. The rust pustules are shown on the leaves and branches. The rust, here provisionally named *Melampsora lini*, Pers., may be described as follows:—

Uredo Stage.—The nearly spherical orange-coloured uredospores form on the stem, leaves, sepals, and capsules of the host plant golden yellow round to oblong, or (on the stem) even linear pulverulent sori, which vary from one to five millimetres in length, the larger sori being undoubtedly due to the confluence of several smaller ones. While yet young the sori have the appearance of small blisters. When the uredosori are mature, the leaves of the host plant are sometimes completely obscured by the powdery mass of uredospores present on its surface. A leaf but little more than an inch in length may bear as many as 200 sori, and even the average number of sori on a leaf often exceeds 100. The uredospores are borne on stalks among numerous capitate paraphyses (see Fig. 14.) These paraphyses occur throughout the sorus, but are less numerous near the centre. Their nearly transparent, smooth, spherical to clavate heads are somewhat larger than the spores, and are borne on stalks longer than those of the spores. The marginal portion of the sorus is composed completely of paraphyses, a fact easily demonstrated by means of sections through the sorus, or by examination from above with a medium power. Each sorus is enclosed in a pseudoperidium composed of a single layer of spherical, or, rather, polygonal cells, whose diameter is about one-third as great as the transverse diameter of one of the epidermal cells of the leaf of the host-plant. This pseudoperidium is often visible to the unaided eye as a somewhat lacerated membrane bordering the sorus. It has been mistaken for the ruptured epidermis of the host-plant. It is easily removed for examination, or its existence and structure may be demonstrated by cross-sections of the sorus. A similar pseudoperidium is known to exist in *Melampsora populina*, and in a few other cases. The origin and development of these pseudoperidia of the uredospore sori have not yet been sufficiently investigated. Such well developed and persistent enveloping membranes are well-known characteristics of the *Æcidium* stage of numerous rusts, and the appearance in the uredo stage is another morphological evidence of the genetic connection between the old form-genera *Æcidium* and *Uredo*. The finely echinulose uredospores germinate readily, and when doing so give evidence of the presence of at least three or four germ spores. They throw out about two hyphæ, only one of which is likely to grow vigorously. This one is of irregular diameter, and often, though not always, gives rise to numerous finger-shaped branches; the total length of the system thus produced often exceeding ten times the length of the diameter of the spore. The germinating spores measure 23 to 29 μ in diameter, being nearly spherical.

Puccinia Stage.—The sessile, one-celled, cylindroid, or perhaps it would be better to say prismoidal, brownish teleutospores are closely packed in dark brown sori, principally on the stem of the host-plant, and for some time remain covered by its epidermis. They are from four to five times as long as broad (11-15 x 57-73 μ), being straight near the centre of the sorus, and slightly curved near the margin. At the free extremity of the teleutospore, where the wall is thicker and darker brown, is found a single germ-pore.

The above-described rust may not be *M. lini*, Pers. It is common in New South Wales on *Linum marginale*, a native flax, and has been found on experimental crops of linseed—that is, *Linum usitatissimum*. The linseed is much injured by the rust. According to Barclay, this fungus is apparently extremely common over large areas of the plains in India. The specimen forwarded by Mr. Clout, of Rosemount, Brungle, is a plant grown from Indian seed. Mr. Clout said New Zealand seed gave sound plants.

Various inquiries about the rust on flax lead me to point out that this rust differs materially from that attacking wheat, however much alike the two may appear to the unaided eye, and that it never attacks wheat. Nor does the wheat-rust ever attack flax.

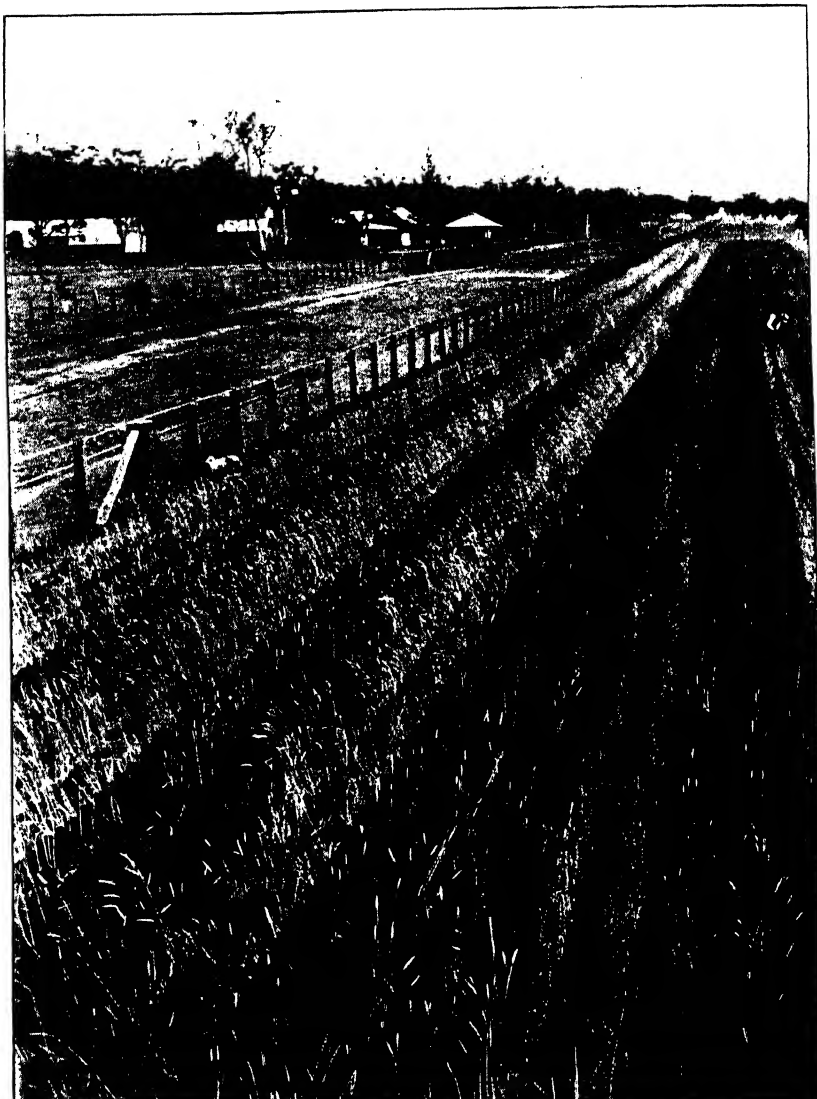

Fig. 12.—Photograph of part of the manure experiment plots, Wagga Experiment Farm, conducted on the row system. Each long row is compared only with that which stands next to it. This is the third year of the experiments. The average results should be ready for publication in about a year. The results are tabulated most carefully each year, and are open to inspection, but it is the desire to avoid any premature publication. A variety of seasons must be tried first. This part of the manure experiments is directed towards the solution of the questions relating to the application of artificial manure to late-sown wheat, and to the hastening of the maturity of wheat in general questions which have arisen out of my investigations into the best methods of combatting the disease of wheat known as rust. The road alongside the manure plot leads to Wagga. The buildings, about a dozen in all, are the students' quarters and farm buildings. The trees in the far distance are in one corner of the Wagga Common.

On the other hand the wheat-rust does sometimes attack various grasses, but unfortunately I have been obliged to answer inquiries on this subject for the most part somewhat as follows:—"It is difficult to recommend any

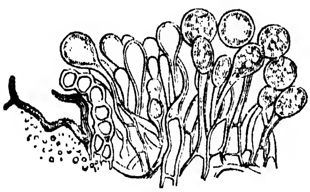

Fig. 14.—Section through part of a flax-rust pustule, showing on the left the marginal peridium of the pustule. x 175.

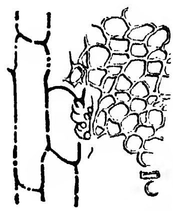

Fig. 15.—Face view of the peridium shown in Fig. 14. The wider black lines are to show the epidermal cells of the flax.

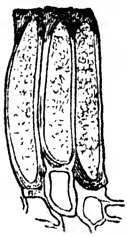

Fig. 16.—Teleutospores of the flax-rust. x 325.

measures against rust on pasture grass. I do not remember to have seen any recommendations on the subject that appeared to be of much value, and my own investigations have led (so far as pastures are concerned) to no practical remedies. Remedies there are, such as spraying with copperas, &c., but the necessary machines are not to be procured in the Colony, and the process is too expensive in any case. No doubt burning off the grass would do something towards lessening the loss, but to be effective the burning would have

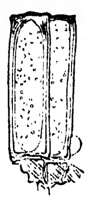

Fig. 17.—Teleutospores of the flax-rust, differing somewhat in form from those shown in Fig. 16. x 325.

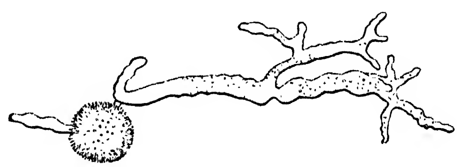

Fig. 18.—Uredospore of the flax-rust, germinating.

to be simultaneous by owners over a large area. Some grasses are much less liable to rust than others, but unfortunately the best grasses for the South Coast districts are the very ones that are most liable to rust. I refer to rye-grass and the various species of Poa."

5. Smuts and Bunt.

Probably no diseases bring me more inquiries from growers of wheat and maize than do smuts. In spite of the fact that the subject of smuts is easy of mastery there is a great deal of ignorance and misapprehension concerning it. I wish the whole community could adopt more precise language in speaking and writing on this question. To this end I wish to explain that our wheats are subject to three diseases of this kind—

1. *Loose smut*, which turns the whole ear to a black mass.
2. *Bunt*, which does not much disturb the form of the ear, but converts each grain into a small ball filled with a stinking black powder.
3. *Flag-smut*, which breaks out on the flags principally.

This latter is disregarded in these pages, because it is uncommon in this Colony.

Loose smut first appears at the time the wheat comes into flower, and this fact is in itself almost a guarantee that this is the period at which it infects the next crop.

Bunt, on the other hand, does not break loose from its ball-like enclosures until harvested and threshed. That is the period at which it infects the next crop, either through immediate contact with healthy seed or by becoming disseminated on the land so as to infect the seed when sown.

Treatment either with hot water for fifteen minutes at 130°–135° Fahrenheit, or soaking in a weak solution of bluestone or sulphide of potash will prevent the appearance of bunt.

In case of loose smut of wheat, however, I still doubt if any of these treatments can be guaranteed to do very much good. I have treated thousands of samples of wheat with hot water for instance, and while I observe that I am thus able to largely control the disease called bunt, the results as regards loose smut are very uncertain—so uncertain that any success I may attain I am inclined to put down to some unknown factor. For one thing it seems very reasonable to suppose that the state of the weather at the time of blossoming (*i.e.* time of appearance of the loose smut) must have a great influence on the prevalence of the disease the next season, although it is difficult to advance the precise reasons beyond what has been already said.

It is not uncommon for me to receive letters stating that seed wheat treated with solution of bluestone has produced a smutty crop. In most such cases I find the disease to be loose smut, which is again confirmatory of the comparative inefficiency of the above treatments so far as this disease is concerned.

I have found the most certain preventive measure to be the plucking and destroying of all loose-smutted heads. I fancy the owner of a thousand acres of wheat will smile at the idea of going through it and weeding out and burning the smutted heads. That, however, will be because he does not understand my meaning. To make it clear I will describe the method adopted and successfully carried out for four years at Wagga.

To begin with, the seed for the Wagga Experiment Farm was collected during the years 1890 and 1891 from all parts of the world, and it is quite safe to say that I received along with it quite a fair share of every important wheat disease. Stud plots were started, and were located as they should be, namely, on the side of the farm or paddock towards the prevailing wind, or, if not, then at a distance from all other wheat. Unfortunately this rule has sometimes had to be abandoned, but always, I am now convinced, with disadvantage. Each stud plot, one for each principal variety, was grown from selected seed. When ripe, and during growth, the plants were inspected, and all the diseased ones removed and destroyed. This gave a crop of healthy seed. The reason the windward side of the field was preferred as a location for the stud plots was the fact that in that position fewer spores, either of smut or other diseases, would be blown on to the plants it was desired to improve by selection. They would thus be kept all the more free from disease. A few of the very best plants from each stud plot were reserved so as to secure seed for a similar stud plot next year. The remainder (after all undesirable plants had been culled out) was used as seed wheat next year, and produced a few acres of as healthy wheat as could be obtained. The seed, being derived from healthy plants, did not need to be treated with hot water or anything else, so this expense was saved. These few acres were subjected to a less rigid

Fig. 19.—Partial view of two stud wheat-plots at the Wagga Experiment Farm. The plot on the left has been weeded out as described in the text; so has the plot on the right. The four rows in the middle of the picture have not been weeded out. It will be noted that in some parts of the left-hand plot nearly all the plants have been pulled up and removed for one reason or another. The plants left standing, having passed the inspection, are next reaped and threshed. The wheat stooked in the middle distance came from a stud plot of the year 1894—in other words, is the second generation of seed from just such a plot as is shown in the foreground. The distant paddock, just this side of the uncleared land, is uncut wheat, also on the Experiment Farm.

inspection and again used for seed, this time producing (say) 50 acres of wheat. Meanwhile the second stud plot had furnished another half bushel or more of healthy seed, and a few extra good plants with which to start a third stud plot.

The continuance of this system, when once inaugurated, insures a constant supply of healthy seed wheat of superior quality; and of the good results of the method, I wish to give farmers the most positive assurance.

Though the carrying out of this system with such a large number of wheats as are handled at the Wagga Experiment Farm is somewhat expensive, the extra cost is due solely to the strict and skilled supervision that has to be exercised in order to insure accuracy in the work. With only one or two varieties on an ordinary farm the method is a very simple one, and one that should be very widely adopted.

About three years are required to get this system of producing seed wheat into good running order, after which it will give very little trouble, and pay its way ten times over every year in the superiority of the resulting crops, not only through their freedom from smut and other diseases, but in extra yield and quality of the grain.

There is, however, one factor in this method of wheat-growing that must be watched, and that is the land on which the bulk of the wheat grows. If this land is contaminated with bunt to begin with, bunt will continue to appear in succeeding crops. This can be largely prevented by introducing a change of crop, or by fallowing the land.

For the full particulars of the method of treating the seed with hot water and with bluestone I must refer the reader to vol. II, p. 672, of this *Gazette.*

6. Maize Smut.

Formerly, when writing on maize smut, while suggesting treatment of the seed with bluestone or hot water, I threw doubt on the efficacy of these treatments, and strongly advised that, where small areas of maize were grown, all smutted parts of the plants should be collected and burned, especially if maize was to be sown again immediately on the same land. I did this from life-long familiarity with this disease, and the failure, in my own case, of any method of combating this disease, other than that of destroying the smut as fast as it appeared. As, however, owing to the great similarity of the maize smut-fungus to others which were known to enter the crop by way of the seed, it seemed probable that maize-smut also attacked the seed, more especially as this was already widely assumed to be the fact, I thought best to give countenance in this journal to the treatment of the seed, as was the custom in other pathological publications. Now, however, Dr. Brefeld, who for many years has made a speciality of the smut-fungi, after long and careful study, has come to the conclusion that maize first becomes infected with smut after it is at least a foot high, and principally through the spores of the fungus dropping into the "cone" formed by the latest well-developed and topmost leaf. This important discovery is in full accordance, I believe, with the experience of those who, like myself, have produced no satisfactory results by treatment of the seed of maize that is grown in the ordinary way. The full significance of this matter is not fully grasped until we realise that *henceforth we are relieved, so far as maize smut is concerned, from the expense of treating the seed.* This is no small item when considered in a national light.

7. "White-heads" or White Blight of Wheat.

A disease often spoken of as "white-heads," characterised by the bleached appearance of the full grown wheat plants, and by the absence of grain from the heads, is not infrequently the subject of inquiry by farmers. This disease was treated of in my article on Take-all,* under the special name of "White Blight." Observations and experiments since made confirm the opinion that this disease is one connected more particularly with the soil, though probably some organism is the primary cause. The treatment formerly recommended is still more fully endorsed.

Remedy.

Apply lime to the diseased patches as a manure, at the rate of about 1 ton per acre. In the absence of lime, the ashes obtained in burning off may be utilized with almost equally good effect.

II. Diseases of the Plum.

Disease of the Japanese Plum.

Numerous varieties of plums, especially Japanese varieties, have been sent to me this season, attacked by a disease about which I have as yet discovered little except that it was undoubtedly serious. The fruit is misshapen, failing to grow, more particularly on one side. The defective side has an irregular and roughened surface, from cracks in which gum sometimes oozes. With the prevalent notion that the disease is "sun-scald," *i.e.*, is due to the heat of the sun, I cannot agree, because as often as not I find the diseased side turned away from the sun. The disease seems to me to be one connected in some way with the wood, and to be perhaps related to the disease known as gumming. I suspect it to be transmitted through grafts.

Remedies.

1. If a tree shows the disease very badly for three years in succession either remove it or graft on another variety known to be not subject to the disease.
2. Do not buy trees except under a guarantee that they are grafted from healthy trees.
3. Do all you can to spread the information that cuttings taken from diseased trees are likely to produce diseased trees even if grafted on to healthy stocks.
4. I can hold out little hope that any sort of spraying will be beneficial, but if other trees are being sprayed there would be no harm in trying the effect of Bordeaux mixture on this disease.
5. According to my observations plums grow to the greatest perfection on limestone soils. This seems to point to the use of manures rich in lime. Potash is also desirable.

The letters accompanying these specimens of diseased plums have sometimes inquired whether the disease is not "Plum Pockets." So far as I know, the disease known by the name of Plum Pockets does not occur in this country. As the name of this latter disease implies, the plums are converted by it into "pockets," that is they become hollow and have *no stone.* I have never seen such objects in Australia, and therefore conclude that they are at least uncommon.

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* *Agricultural Gazette of N S W.*, Vol. III, p. 931.

III. Diseases of the Apple.

1. Bitter Pit of the Apple.

I mention this disease only to state that Mr. Robinson, of Ashfield, at my suggestion, has undertaken some experiments in order to find out if possible whether this disease is transmitted by grafting, as I strongly suspect it is. The results will be made known in due time. I think it will be no breach of confidence to mention that experiments conducted by officers of the Victorian Department of Agriculture are believed to show that this disease cannot be alleviated by any kind of manure.

2. Canker.

The common and wide-spread diseases of the bark of trees known under the general name of *canker* continue to trouble our orchardists as of old. A few words suggested by the nature of the specimens and inquiries I have received during the last few months may therefore be of service.

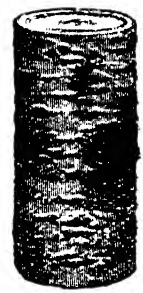


Fig. 20.—Canker on a limb of apple. The disease appears in this case as small elongated brownish "blisters," arranged transversely on the limb.

The cause of most canker spots is external. Frost, sun, hail, insects, or violent winds first of all injure the bark, and then some parasitic or semi-parasitic fungus attacks the wound thus made and increases the "sore" faster than the bark can produce "healing" tissue. The process goes on from bad to worse until, in some cases, it seems as if there were no limit to the consequent "sore" or excrescence. I have seen such deformities a yard or more in diameter. The disease is generally long drawn out, and in the case of fruit-trees is particularly disheartening when severe. Among fruit-trees, apple-trees are probably more subject to canker than any others, though even they are less subject to it than some timber trees. As a matter of fact, nearly all the specimens of canker recently sent to this Department from the orchardists of the Colony are from apple-trees. Those who are curious concerning the nature of the fungi causing canker may find some satisfaction in studying the adjacent illustration, which was prepared from some diseased material sent me recently, and when they have done so will readily understand why the following recommendations were made.

Remedies.

1. Prune off or cut out the worst cases, and then apply grafting wax to the freshly-made cut. Use sharp tools and do not cut sparingly. If you do not remove all the diseased bark, the disease will remain and continue to spread. Cut away all the bark that appears in the least swollen, discoloured, or in any way unhealthy. Burn the cuttings.

2. As soon as you can find out the original cause of the wounds remove it. If it is the sun scalding the bark, prune the trees so as to cause the foliage to shade the limbs and trunks more completely; protect the trunks of young trees from the sun by some artificial means if necessary. Provide windbreaks. Remove any superfluous old bark, the scales of which may harbor insects.

3. Whitewash is a good substance to apply as a destroyer of the spores or other propagating agents of the fungus. Bear in mind that a thin whitewash can be very economically applied with a spray-pump and a coarse Nixon

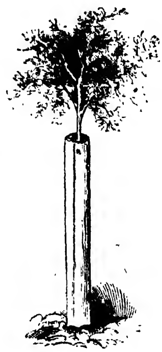


Fig. 21.—Showing young fruit-tree whose trunk is protected from the full force of the sun's rays by means of a cylinder of very thin veneer sawn from bark or other material.

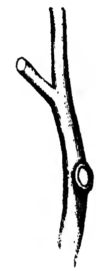


Fig. 22.—Limb of a tree showing proper and improper pruning. The upper branch has been sawn off too far from the main limb. The lower branch, having been sawn off close to the main limb, will heal over more successfully, and give canker fungi much less opportunity to gain entrance and do damage.

nozzle. One advantage of this method of applying the wash is that the smallest twigs can be whitewashed, a thing not feasible with a brush.

4. A winter spraying with the strongest Bordeaux mixture will do good. The great advantage of a winter spraying is that the solutions may be used much stronger than when the tree is in leaf. Solutions that would injure the foliage may be applied in winter to the bark and buds with impunity.

How simple and reasonable all these remedies seem when once the nature of the disease is understood!

IV. Diseases of the Potato.

1. Wet Rot.

While the name *wet rot* is very descriptive of this disease, the name *stinking rot* would be still more appropriate. The disease attacks potatoes in the ground as well as in store, and reduces the tubers to disgustingly stinking, almost liquid masses of mattery-looking rot. Often the whole potato is found so rotten that the slightest attempt to move it causes it to collapse into a semi-liquid mass. Again, only part of the potato will show the liquid rot, the remainder having not yet succumbed. In the earliest stages, while the potato is still hard, the rot may be detected by a dark band which can be seen somewhat below the skin when the potato is cut in two.

Though it seems fairly certain that the disease is caused by a microbe, it is as yet uncertain what is the exact relation of the microbe to the potato plant. The disease never occurs without the presence of the microbe, and the disease may be transferred from one potato to another with great ease, merely by inoculation with some of the putrescent rot. The microbe has been isolated and cultivated and described. The difficulty arises when we come to consider the relations of the microbe to the stalk of the potato. A disease-producing microbe occurs in the stalk, more particularly in connection with the fibrovascular bundles, it is said, and the question that naturally presents itself is this, "Are these microbes in the stalks identical with, or in any way related to, those in the tubers?" and this question has yet to be definitely settled. Fortunately for growers these questions do not stand in the way of suggesting very definite and effective remedies.

Remedies.

1. Avoid seed from a crop that has shown wet rot.
2. Buy seed only on a guarantee that it comes from a perfectly sound crop.
3. Where land has borne a diseased crop of potatoes, do not again immediately use it for potatoes. Give it a rest, or put in some other crop.
4. Land lower down than that suffering from wet rot and receiving drainage from the contaminated land will also sometimes develop the disease. Avoid such land for potatoes.
5. Destroy the worst affected potatoes by fire. Boil the remainder of the diseased tubers for the pigs, poultry, or other stock. The apparently sound portion may be used for the table. In fairness to other people such potatoes should not be sold, except with a full statement as to the facts of the case.
6. Disinfect all bags, bins, and other receptacles that have held wet-rotted potatoes. Boil the bags and whitewash the bins. I believe the steamboats plying along the coast and to Tasmania and New Zealand are responsible to a considerable degree for the spread of this disease. The precautions just mentioned are inexpensive, and might with advantage be more often adopted by the steamship companies.
7. Do not store diseased potatoes along with healthy ones.
8. Pick over the stored potatoes from time to time. Throw out and destroy the diseased ones.
9. Induce as many of your neighbours as you can to adopt these precautions. Their vigilance will benefit you.

Potato Scab.

This is a well-known disease of the potato, characterised by the scabby appearance of the whole or part of the surface of the tubers. The same

Fig. 23.—Photograph of a scabby potato, natural size. The roundish and irregular-shaped rough and corroded spots are due to the attacks of the scab organism, and it is from these scabs that spores or other agents responsible for spreading the disease are derived. The depth to which some of the scabby spots extend is well shown at the top of the illustration, where a deep cavity is shown in profile. By soaking the potatoes in corrosive sublimate solution these scabs are sufficiently penetrated by the poison to be well disinfected, yet the potato tissues themselves, being comparatively impenetrable, are not injured.

disease is said to occur on beet-roots. It occurs in all sorts of land, but is more prevalent in sandy soils and in soils containing much lime, and is said to be more virulent in crops fertilized with manure containing much common lime, or with wood ashes. The disease is confined largely to the tubers, the appearance of which, when thoroughly diseased, is shown in the above illustration.

The cause of the disease is still in dispute, but there can be little doubt that it is a minute vegetable organism. On the one hand it is claimed by some who have investigated the disease with care—and their view has at present the most supporters—that the cause is a fungus of low degree,*

* The Oospora scabies of Thaxter.

and on the other hand by others who also seem to have been careful, that the cause is a microbe. These latter do not deny the presence of the fungus first mentioned, but suggest that it is a concomitant of the microbe which really causes the disease. Here again, however, the doubt as to the precise course of the disease has not prevented these specialists from deducing from their investigations certain remedies which are, on all sides, admitted to be very effective.

Remedies.

1. Avoid seed from your scabby crops.
2. Buy seed only under guarantee that it comes from a perfectly healthy crop.
3. Where land has borne a scabby crop do not immediately again use it for potatoes, unless the seed be soaked in corrosive sublimate.
4. Land lower down than that suffering from scab, and receiving drainage from the contaminated land, may also develop the disease. If convenient, avoid such land for potatoes.
5. If land that is subject to scab is to be again planted with potatoes, or if scabby potatoes must be used for seed, soak the seed for one and one half hours in a solution of corrosive sublimate, made by dissolving 10 ozs. of corrosive sublimate in 60 gallons of water.

Corrosive sublimate, or as it is otherwise called, bi-chloride of mercury, is a violent poison if taken internally, and should be handled and stored with care. It must not be placed in contact with metals, as it corrodes them rapidly, and at the same time loses its own properties. The solution used for soaking the potatoes must be placed in a wooden vessel having no internal metal parts. There is no danger in putting the hands into the solution, but it would be well to rinse them afterwards in pure water. The solution does not injure cut potatoes, and if the potatoes are to be cut for seed they should be cut before being soaked, as the cutting of the soaked potatoes would be ruinous to knives. Plant the potatoes without rinsing them, but allow them to drain. Corrosive sublimate can be had from any chemist, and costs from sixpence to a shilling an ounce. Several bushels of potatoes may be treated for a few pence, and the treatment is very effective.

6. Boil up the worst of your scabby potatoes and feed them to stock. Also boil or burn the parings of such scabby potatoes as may have been used for the table. Scab begets scab, and the more of it there is left about, the more will be begotten to attack your future crops of potatoes.
7. Disinfect all bins, bags, and other receptacles that have held scabby potatoes precisely as for wet rot (See p. 223.)
8. Do not store scabby potatoes along with healthy ones, though this recommendation has much less force in connection with scab than in connection with wet rot.
9. In case you are troubled with scab, avoid for potatoes, barnyard manure and such fertilizers as contain much lime. Wood ashes are not desirable where scab is prevalent, and potash should be supplied in some other form. Carbonates should also be avoided. There are plenty of artificial manures so concocted as to avoid the above pitfalls and yet be very suitable for potatoes. Moreover, it appears that such fertilizers are themselves to no inconsiderable extent a remedy for the disease, especially on so-called sour soils deficient in lime.*
10. Induce as many as possible of your potato-growing neighbours to adopt the above precautions. If they adopt them you will also be benefited.

* Wheeler, Tower, and Tucker, R.-I. Exp. Station, Bull. 33, 1895.

Caution.—There is a moth, *Lita solanella,* whose grub attacks potatoes, and causes appearances which sometimes resemble scab. These deceptive appearances, due to the attacks of the potato moth, have given rise to trouble in the following manner. The grower, mistaking the moths' ravages for scab, treats his seed-potatoes with corrosive sublimate, with no benefit, and thereupon denounces the remedy. This is an unfortunate mistake, because although the corrosive sublimate solution is almost harmless to the potato-moth, it is very effective indeed against potato-scab. The ravages of the moth are easily detected by cutting open a few potatoes. The passages eaten by the grub will be seen under the skin, and even going right through the potato from side to side. The grubs are also easily found. Scab does not *penetrate* the potato as the grubs do.

V. Diseases of the Orange.

The Australian diseases of the Citrus fruits have never yet been properly investigated, and the following notes on this subject are only such as my recent letters contain. They may, however, serve as an introduction to a more complete report which is in preparation.

1. Melanose. (?)

This disease is very well illustrated by the photographs I have taken at various times from specimens sent me or gathered for the purpose during visits to various orchards. (See figs. 26 and 29.) I have little doubt that this disease, as it occurs in Australia, is identical with that described by Messrs. Webber

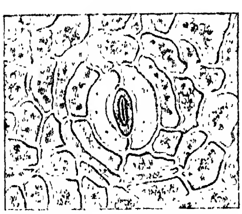


Fig. 24.—Healthy breathing pore in the skin of an orange as seen under the microscope. The cells of the orange-skin are shown containing bodies derived from the chlorophyll bodies, but now coloured with an orange pigment. The two large crescent-shaped "guard-cells" are shown encircling the elongated breathing pore.

Fig. 25.—The beginning of one of the numerous small spots characteristic of the disease Melanose (?). Each spot begins at a breathing pore. This illustration should be compared with Fig. 24. It will be seen that the interior cells of the skin of the orange have begun to alter in colour. The guard-cells have begun to disappear, and faint traces of mycelium can be seen in the dark colouration near the breathing pore.

and Swingle as occurring in Florida. Still, my observations do not altogether agree with theirs, and the two diseases may be different. Until a definite difference can be pointed out, I prefer to adopt their melodious name.

The differences I note between what I have seen and what the Florida specialists have recorded in the only report of their work that I have seen, are briefly the following. The numerous small madder-brown spots, characteristic of the disease, have a tendency on our varieties of orange to group themselves in curved lines, somewhat like those charted archipelagoes, due to sunken mountain chains, which one may observe at various places on a globe or map of the world. This resemblance is so striking that before I had seen the American report I had begun to call the disease the *archipeligo disease,*

a perpetration which I gladly abandoned in favour of the more euphonious American term. Again, I note that the small diseased spots start at the breathing pores, or stomata, of the orange, as shown in the above wood-cuts, which have been very carefully prepared, and give an excellent idea of the appearances, as seen with the microscope. Moreover I find, on examination of the edge of well-developed spots, a well-developed but somewhat peculiar mycelium. This is better pictured in Fig. 27 than in any words of mine. Finally, I note that on the leaves the spots due to this disease are more elevated and blacker than on the orange.

Fig. 27.—Mycelium and conidia from the edge of one of the small diseased spots shown in Fig. 29, &c. Magnified about 350 times.

I can have no doubt, and I think the scientific reader who trusts to my accuracy of observation will agree with me, that the fungus mentioned and pictured above is the cause of this disease. Experiments have shown me that the mycelium of this fungus ceases to grow after the application of even weak Bordeaux mixture, and experiments in the orchard, so far as they have proceeded, confirm those made in the laboratory. Moreover, both these results are in accord with those achieved in the orchards of Florida.

This disease is known to our orchardists, in the county of Cumberland at least, as Orange Rust, and occasionally as Maori. I think both these names should be abandoned in favour of Melanose. The disease is in no sense a "rust," the name of "rust" being one that should be reserved for those diseases caused by fungi related to the well-known wheat-rust. Maori is a name already in use for a distinct disease of the orange, concerning which I will here only remark, that it sometimes resembles Melanose in a very marked degree, a fact that is sometimes very puzzling to orchardists, especially as the two diseases often occur on the same orange, as shown in one of my photographs on the opposite page.

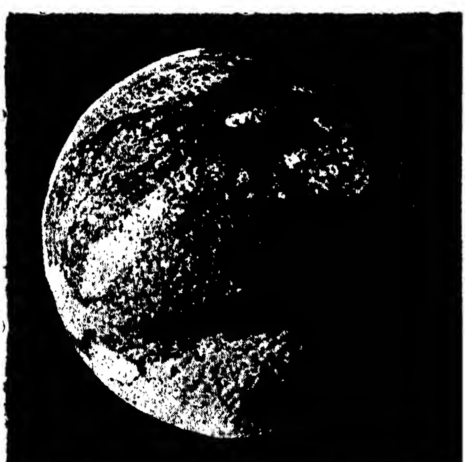


Fig. 28.—An orange affected with the disease known as Maori, showing the *continuous* nature of the brown colouration characteristic of this disease. The colouration does not in this case extend over the whole orange, though such is frequently the case.

There is no doubt that Melanose is doing much damage among the orchards around Thornleigh and Parramatta. Last season oranges spotted over with the disease were to be found in the Sydney market literally by the ton. Even where the tree is not prevented by the disease from bearing a crop of fruit, the surface of the fruit is so disfigured by the multitude of small dark spots as to have its market value seriously diminished. In

Fig. 26. The disease Melanose (?), as it appears on the fruit and leaves of orange-trees at Pennant Hills, about 10 miles from Sydney, N.S.W. The two left-hand oranges show the disease without any complications, the upper one more especially showing the arrangement of the small diseased spots in archipelago-like groups, while the lower shows a more advanced stage of the disease in which the spots have run together (lower left-hand part), or have developed a distinct mycelium at the edges (upper right-hand part). The right-hand orange shows the disease Maori as well as Melanose, this latter disease appearing somewhat in the shadow of the leaves, while the Maori is most conspicuous on the extreme right. All the leaves show Melanose (?), but it is most marked on the lowest leaf. The bark of the young twigs is also slightly attacked. As this photograph was taken in the orchard from perfectly fresh material the effect is very faithful and lifelike

vain the vendor says, "Oh, that? That's nothing; quite harmless!" The customer shakes his head, and can be tempted only with a low price. Unfortunately this is not the worst feature of the case. Many trees are now suffering so much from Melanose that the crops are diminishing; and I have seen trees in a dying condition, that seemed to be suffering principally from this disease.

Remedies.

1. Prune the trees rather severely, taking the precaution to remove the branches that show the most disease. Prune with an eye to spraying, that is, leave the tree so that every part will be accessible to the spraying machine nozzle. Burn the cuttings.

2. Begin as soon as the fruit has set, and spray with Bordeaux mixture, of one-half the usual strength, once every ten days or two weeks, until about a month before the fruit ripens. The Bordeaux should contain only 3 lb. of copper sulphate to 40 gallons of water, or it may even be more diluted than this. Bordeaux mixture of the usual strength sometimes injures orange trees.

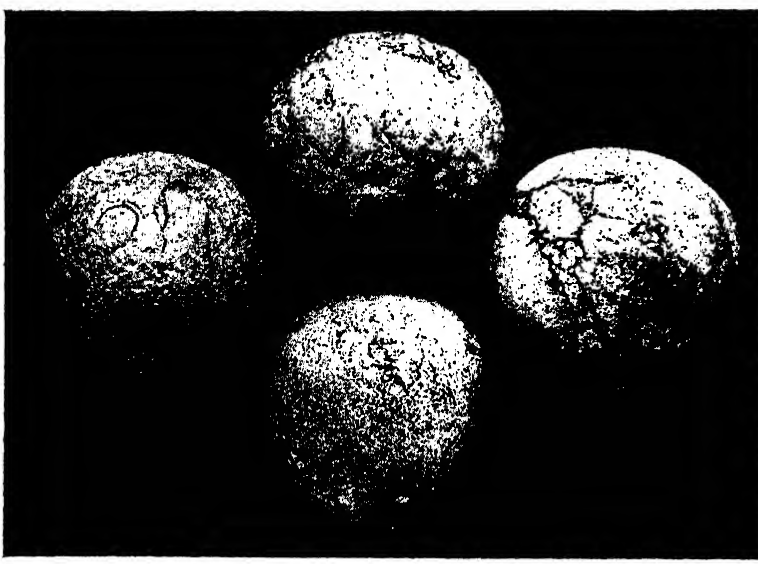


Fig. 29.—Four oranges attacked by Melanose (?), showing the curved markings caused by the peculiar arrangement of the small diseased spots. Though these small spots may run together, more or less, so as to cause brownish patches somewhat resembling Maori, they never become amalgamated into the uniform continuous colouration characteristic of the latter disease. However much they may run together they never cease to be spots; so that any patches of colouration they may cause are discontinuous—palpably made up of spots.

3. Spray the trunk and larger branches with thin whitewash or full strength Bordeaux mixture.

4. Apply to the ground under each tree half a pound or more of sulphate of iron in 25 gallons of water; all the better if applied during a dry spell.

5. Give the trees phosphate and potash manures, but avoid organic nitrogenous manures, such as dried blood and rich stable manure. The use of somewhat bleached stable manure that will act also as a mulch is not hereby deprecated.

6. See to it that the drainage is good. Bad drainage is a prolific source of disease among orange trees.

Fig. 30.—Young orange stock, one-half natural size, the bark of which has been attacked by a fungus. The diseased bark is shown in the lower part, where it is more or less yellowish, being very much lighter coloured than in the upper part *c*. From *a* to *b* the bark is cracked. The fungus whose spores are shown in Fig. 30 occurs more particularly in the neighbourhood of these cracks.

7. Where the use of too much organic nitrogenous manure has already caused a rank soft growth of foliage particularly subject to disease, this objectionable material may be absorbed from the soil, according to Webber and Swingle, by allowing the weeds to grow.

8. If possible, induce your neighbours to adopt these precautions. Your fortune is more or less bound up in theirs, so far as contagious diseases are concerned.

2. Mal di Goma.

This is a disease of the bark of citrus-trees which rarely extends more than 18 inches above the ground, and hence is sometimes also called collar rot. It

Fig. 31.—Spores of the fungus found attacking the bark of young orange-trees, and causing the appearance shown in Fig. 28. These ellipsoidal, colourless, smooth-walled spores arise from minute dark pustules occurring singly or in groups here and there on the bark. The spores measure $3-3{\cdot}5 \times 3-6\,\mu$.

attacks trees of all ages, and is more particularly found where the drainage is bad. The bark first of all turns yellowish, and has a gummy consistency and a sour or fermenting odour. The disease continues to spread until, in some cases, the tree is girdled and dies.

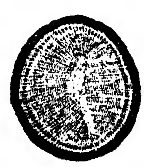


Fig. 32.—Cross-section, natural size, of the young orange-tree stalk shown in Fig. 30. This section was taken near *c*, and is in a fairly healthy condition. The bark is shown dark, and the wood radiated. Compare with Fig. 33.

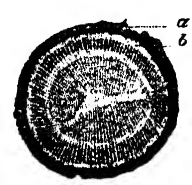


Fig. 33.—Cross-section, natural size, of the young orange-tree stalk shown in Fig. 30. This section was taken near *b* Fig. 30, and shows the effect of the disease. One of the cracks in the bark is shown at *a*. At *b* the effect of the disease is shown on the newly formed wood, which has become thickened. Compare with Fig. 32.

Occasionally half girdled trees recover themselves, and go on growing and bearing, though the trunk does not heal over.

Observations have been made tending to show that this disease is caused by a fungus, but some doubt seems to exist as to the real cause. The illustrations herewith,

Fig. 34.—Oranges attacked by so-called "Black Spot." The diseased spots occur as more or less isolated roundish sunken, at first dark-coloured spots, the interior portion of which, however, at maturity is lighter coloured, with small dark spots (pustules) at the points where the spores break forth. These five oranges show no other disease all the various defects seen on the skin are due to Black Spot.

show that in at least one case of apparent *Mal di Goma*, forwarded to me at my special request, a fungus occurred in the diseased bark. The nature of the case is well shown in the engravings and their subjoined explanations.

Remedies.

1. Cut away the diseased bark with sharp tools. Cut well into the wood and remove every particle of diseased-looking bark. It is better to cut away too much than too little. Burn the cuttings, and smear the cut surface over with grafting wax.
2. Remove the earth from near the base of the tree and apply two or three pounds of slaked lime.
3. Secure good drainage.
4. Avoid organic nitrogenous manures, such as dried blood and rich stable manure.
5. Whitewash the trunks with a spraying machine, or with a brush.

3. Verrucosis.

This is a disease that affects lemons particularly, giving rise on the fruit to unsightly warts of a light brown colour which are particularly noticeable on the lemons when they are green. The disease causes many young lemons to drop off, and it so deforms many others as to cause them to be comparatively worthless. The disease is of fungous origin, and is said to yield to systematic treatment with Bordeaux mixture. For specific directions the reader is referred to the remedies given under "Melanose," p. 227.

4. Die-back.

This disease appears to be somewhat uncommon in this country, but cases have been referred to me that appeared to be no other than cases of dieback. There was the same abundance of small foliage of unnatural colour, and so forth, but the matter must remain unreported upon until I obtain further information, to which perhaps some of our orchardists may assist me.

5. Black Spot of the Orange.

This disease is one that is very prevalent in some of the orange orchards near Sydney. Like Melanose it lowers the market value of the fruit. It also makes it impossible to keep the fruit in store, as the spotted oranges soon become rotten. The appearance of Black Spot on oranges is well shown in the accompanying illustration. (Fig. 34.) It will be seen that the round sunken spots are large and conspicuous, and seriously mar the appearance of the fruit. The central part of each spot becomes greyish or whitish when the fungus causing the disease is mature, at which time several minute dark pustules appear in each spot. These pustules give rise to a multitude of spores of the form shown in the wood-cut below. These spores arise after the manner of those of the genus Gloeosporium. It is therefore possible that the Australian form is the *Colletotrichum adustum* of Ellis.

The amount of damage done by this disease is variously estimated, but is on the whole, I think, exaggerated. According to my observation it causes much less loss than Melanose, though in some orchards the Black Spot predominates, and in such cases is responsible for much damage.

Remedies.

1. Laboratory observations show that even dilute Bordeaux mixture poisons the spores of the fungus causing Black Spot. This points once more to the

use of this well-known mixture as a preventative. From the nature of the fungus it is plain however that the spray can act only as a preventative, and therefore the treatment should be begun early, and continued right through the season, and results must not be expected to be completely satisfactory the first season. This is owing to the deep-seatedness of the fungus causing

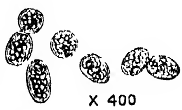


Fig. 35.—Conidia of the fungus causing Black Spot. These ellipsoidal, colourless, one-celled conidia, measuring 7 - 8 x 10 - 15 μ, are enclosed by a smooth and thin cell-wall, and are borne in large numbers in tandem fashion from the mycelium at the base of the interior of the pycnidium in a manner entirely similar to those of the Bitter Rot of apple. Compare with Fig. 36.

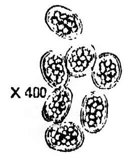


Fig. 36.—Conidia from "Black Spot" as it occurs on the rind of the lemon. Compare with Fig. 35.

Fig. 37.—"Black Spots" on the surface of an orange, natural size. That on the left is from the amalgamation of several simple round spots.

the disease. It will readily be seen that if a disease-producing fungus is growing under the surface of the skin no spray except such as would destroy the skin of the fruit can reach the source of the disease. If, however, a weak Bordeaux mixture be persistently applied, all the spores that arise from the fungus will be killed as fast as they come to the surface, and this must in time stay the spread of the disease. The strength of the mixture should be the same as for Melanose. Begin as soon as the fruit sets, and spray regularly once in about ten days for the entire season. Of course this need not be kept up indefinitely. There is an idea somewhat prevalent that spraying to be effective must be continued indefinitely, and this idea sometimes causes

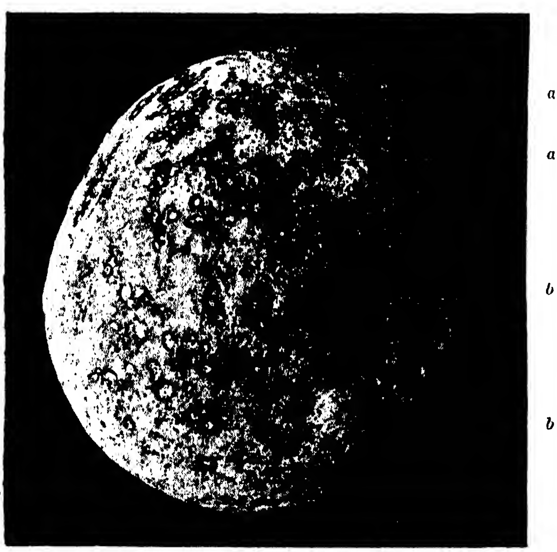


Fig. 38.—Orange attacked by both Black Spot and Melanose (?). *a a*, Black Spot; *b b*, Melanose (?).

spraying to be looked upon as a losing game, and it is indeed true that in many cases, at present prices, spraying, if it must be kept up indefinitely, would never pay. The fact is, however, that if conscientiously carried out for an entire season, or at the outside two entire seasons, spraying, in the great majority of diseased orchards, would effect such a change

for the better that for some time, or even indefinitely, the treatments might be discontinued, or at least made few in number. Those who have looked askance at spraying may, when they consider it in this light, see fit to change their minds. Granting that it is a losing game for one season, how does it turn out in the long run? Will not a possible loss sustained the first season be more than recouped the next season? These are questions that should not be overlooked. And they are questions very pertinent to the disease now under consideration, and to some others of a similar nature.

As to other measures to be taken in fighting this disease I can only refer the reader to the items on pages 227 and 228, under the head of Melanose, with the caution, however, that the utility of some of them in the present case is somewhat questionable. Whenever you can persuade a neighbouring fruit-grower to adopt any of these measures count it as money in your own pocket. Winds and flying creatures are constantly transferring the germs of disease from one orchard to another, so that the health of your neighbour's orchard is a matter that concerns you only somewhat less than that of your own.

To the novice in the diseases of oranges the various resemblances among the diseases Melanose, Black-spot, and Maori are a source of confusion. Two or three of these maladies may appear upon the same tree, or upon the same orange. Such cases, and they are very common, are shown in Figs. 26 and 38. This matter would not be a matter worth mention were it not that the treatment varies for each of these diseases. It is much better, therefore, for the orchardist to be able to distinguish one from the other. A careful comparison of the illustrations with which I am able to accompany this article, and a perusal of the explanatory remarks under each illustration, should enable anyone, it seems to me, to readily identify each of these three diseases. I will only add that Maori is a disease commonly supposed to be caused by a small mite, the result of whose attacks is to cause the skin to turn uniformly brown in colour, like a Maori's face, and not brown in spots as in the case of Melanose.

VI. Diseases of the Peach and Nectarine.

1. Peach Freckle.

This disease occurs also on nectarines, causing the same freckled appearance on this fruit as that which has caused me to give it its popular name—an appearance that is familiar to most people because of its commonness on late peaches.

2. Peach Curl.

This wretched disease is apparently as common as ever. Where a tree has shown the disease badly for three years in succession and in spite of treatment, I would advise pulling it out and burning it. I am far from satisfied with any remedies I have ever tried, or seen tried, or even heard of. The various things that may be tried are here given but without much hope that they will effect a cure.

1. Collect and burn the diseased leaves.

2. Spray with weak Bordeaux mixture once in two weeks, beginning at blossoming time. Precede this by a winter spraying with Bordeaux of full strength.

3. In bad cases cut the tree back so as to cause it to throw shoots from the trunk or larger branches, or graft on some healthy wood.

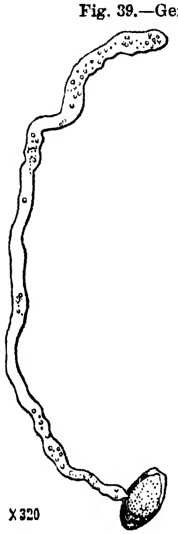
Preventive Measures.

4. Do not buy trees except under guarantee that they are perfectly healthy. *Nurserymen should be very careful not to take scions from peach-trees that have shown the disease.* If this measure could be enforced there would be very little of this disease.

3. Peach Rust.

Rust is the very common disease that in the autumn attacks the leaves of peach, plum, and apricot trees, but especially those of the peach. As a result the leaves turn yellow and fall off sooner than they otherwise would, and

Fig. 39.—Germinating spore of the peach-rust fungus, *Puccinia pruni*, Persoon.



Uredo stage.—The yellowish or brownish ovate to pyriform finely echinulate uredospores are borne on pediceles among numerous transparent capitate paraphyses in round and raised pulverulent light-brown sori, which occur in crowded groups on the under surface of the leaves and young twigs of the host-plant, generally giving rise to a yellow discolouration. The apex of the spore is recognized at once by its darker colour and thicker wall. The pediceles are about twice as long as the spores. On germinating each spore displays three germ pores, but gives rise, however, to only one hypha. Germinating spores average 16 x 37 μ, but vary from 13 x 42 to 17 x 22. The sori measure three-tenths of a millimetre in diameter, but several may run together, giving rise to larger compound sori. On the fruit of the peach the sori are commonly small (punctate) and scattered.

Puccinia stage.—The pedicellate teleutospores, measuring 17 x 31μ, are composed of two nearly spherical cells—a larger terminal dark-brown cell, and a smaller basal cell of a lighter hue—both being flattened at the point of union, and both presenting numerous short but stout spines. The pediceles are of about the same length as the spores. The cell walls are of uniform thickness. The dark brown or black round pulverulent sori are situated as in the case of the uredo sori, and measure one-fourth of a millimetre in diameter.

Hab.—Leaves, young branches, and fruit of the peach, where it gives rise to much trouble, causing the leaves to be shed prematurely, thus diminishing the vitality of the tree, as well as giving the fruit an unsightly appearance. This species is the *Uromyces amygdali* of Cooke, of which original specimens have been presented to the Department by Mr. Bailey, the Government Botanist, Queensland. We do not see that it differs in any marked way from *P. pruni*, Pers., and in the absence of any cultivation experiments must regard the two as identical. Devoured by the larva of a species of *Diplosis*.

the growth of the tree is impeded. The appearance of the disease need hardly be described to owners of peach-trees, it is so very common. Suffice it to say that the rust is due to a fungus belonging to the same family as the common and notorious wheat rust, that it occurs abundantly on the lower side of the leaves in the shape of small pustules, each of which gives

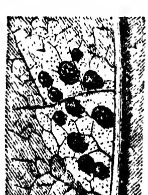


Fig. 40.-Portion of a peach leaf near the mid-rib as seen under a magnifying-glass. Pustules, due to the peach-rust fungus, are shown, and, growing in the midst of them, the dark pycnidia that give rise to the two-celled spores shown in Fig. 44.

Fig. 41.—Spore of the peach-rust fungus magnified more than in Fig. 39.

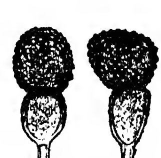


Fig. 42.—Teleutospores of the rust-fungus found attacking the leaves of the plum-tree.

rise to a brownish powder, which, when examined with a microscope, is found to be composed of bodies shaped like those shown in Figs. 39 and 41.

I have made in connection with the fungus causing this disease a number of observations that are of some considerable interest from a scientific point

of view. The uredospores of the disease (the teleutospores are rare on peach-trees in this Colony) can be made to germinate very readily in water in a moist chamber. When so germinating their usual appearance is shown in Figs. 39 and 41. On one occasion, however, I observed an apparent amalgamation of the promycelium of three adjacent spores.

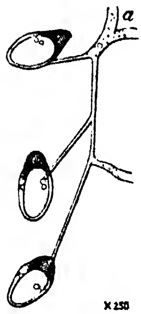


Fig. 43. — Three uredospores of the peach-rust fungus, whose mycelia, germinating in water, have amalgamated.

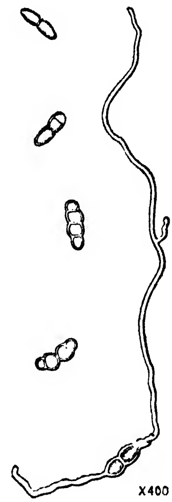


Fig. 44.—Conidia that arise from the minute black pycnidia shown as growing in the rust-pustules of peach in Fig. 40. The upper spore is shown as it issued from the pycnidium, the next lower has begun to germinate. The next two show further stages of the germination, which takes place somewhat after the manner of the growth of the yeast plant. The lower figure, however, shows one of these same spores producing a well-developed mycelium.

The appearances are faithfully shown in Fig. 43. The only doubt that can possibly arise is that the hyphæ became entwined and thus deceived me, but I hardly think this can have been the case. Again, I frequently find among the uredospores of a pustule of this rust small black pycnidia producing a multitude of two-celled spores, which, when placed in a moist chamber, often bud and multiply after the manner of yeast plants, but which occasionally produce a mycelium. Further, I find in the pustules of a number of Australian rusts similar tiny black pycnidia, producing similar two-celled spores which behave in

Fig. 45.—Small black pycnidium growing among the uredospores of the rust of acacia. One of the two-celled conidia arising from this pycnidium is shown above more highly magnified. This rust may be described as follows:—

Melampsora phyllodiorum, B. and Br. Uredo stage.—The round uredo sori, which are only two to three-tenths of a millimetre in diameter, occur on both surfaces of the leaves of the host-plant, and are usually crowded together in large numbers, and then cause wart-like growths of a dark brown colour. The thickening of the leaf under the sori is due to increase in the tissues. The yellowish brown obovate-elongate uredospores are borne on pedicels nearly twice as long as themselves, and are unaccompanied by paraphyses. The spore-wall is moderately thick, and its surface is marked with short obtuse echinulæ or warts, arranged in longitudinal and transverse rows like the grains on a cob of maize. The internal cavity, especially of the transparent young spores, which are as usual larger in proportion to the width than mature spores, is somewhat cylindrical—that is, is truncate at the ends, especially so at the apex. The mycelium averages only 2 μ. in diameter. Each mature spore is possessed of four equatorial germpores, and has, on the average, the dimensions 17 x 41 μ.

As the uredospores fall away a pycnidium appears in their place, apparently from the same mycelium that produced the uredospores, at all events in the centre of the same sorus. These pycnidia are nearly spherical, and have a small ostiole around which the peridium is nearly black. We have seen this growth repeatedly, and have examined it closely by means of very carefully made sections, and believe it to be normal. The connection with the uredospore sorus is so intimate that it is difficult to form any other opinion than that the uredospores and perithecia originate from the same mycelium.

Puccinia stage.—I have not seen the teleutospores.

Fig. 45.

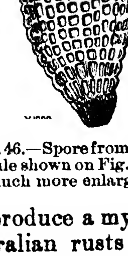


Fig. 46.—Spore from the pustule shown on Fig. 45, very much more enlarged.

precisely the same manner. Among other rusts producing these bodies is that occuring on acacias, and that which occurs on a species of *Agropyron*, probably the species *scabrum*. There are, *a priori*, two ways of accounting for these pycnidia: either—1, they are parasites on the rust; or, 2, they are an integral part of the rust, and represent another spore-form of the rust.

This is such an interesting subject that I have often wished to inquire into it carefully but have not done so, solely for lack of time. Perhaps someone more fortunately situated will undertake the task. These two-celled bodies have, as I have on several occasions publicly remarked, no slight resemblance to the so-called spermogonia of several species of Aecidium, and this idea has already been fruitful of considerable discussion. Do not the various bodies that have in this connection been called spermogonia and spermatia need a more careful examination than they have yet received?

As I before remarked, the teleutospores of the stone-fruit rust (or rusts) are not common on peach-leaves in Australia. I have noticed that when peach-trees grow in close juxtaposition to plum-trees the teleutospores are not uncommon on the peach-leaves as well as on those of the plum. This certainly suggests that there are either two species of rust occurring on the peach or that there are at least two distinct forms, whether or not they be regarded as distinct species. This observation is entirely in accord with the conclusions of a number of observers who have during recent years given close attention to the forms and physiological characters of a number of other common rusts. The form of the teleutospores growing on plum leaves is shown in Fig. 42.

Fig. 47.—Sprig of peach attacked by the well-known shot-hole fungus.

4. Shot-hole.

This disease is one that is very common on the apricot, both on the leaves and on the fruit, some observers to the contrary on this latter point notwithstanding. In Australia, at least, whenever the leaves of apricot-trees are badly riddled by this disease, the fruit rarely escapes injury. One side of the fruit becomes scabby from the attacks of the same fungus that attacks the leaves; and often when the fruit is attacked in a young stage it is ruined, as it fails to grow on one side, and does not make much progress on the other. As to

the nature of the fungus that causes the disease, it has been carefully set forth, more especially in drawings, in previous reports, to which I have had little to add in recent letters except that I have since seen much worse cases on peach-trees than I had supposed possible. The injury on the peach-tree seems, however, to be largely confined to the leaves. (See Fig. 47.)

Remedies.

Spraying with ammonio-carbonate of copper, or weak Bordeaux mixture, has proved a pronounced success wherever it has been carefully tried. The full details have already been published in this Journal, and they need not be repeated here. (See Vol. III, p. 289.)

5. The Crease in Peaches.

I have noted a number of varieties of peaches, more especially late varieties, which have a crease so deep as to be a decided defect. This deep crease harbours both fungi and insects, whose ravages sooner or later cause the peach to decay. This defect in peaches is as bad as the open channel that exists in some varieties of apples, leading from the eye of the apple to the core, and bad for precisely the same reason.

VII. Gall Worm.

Six years ago, when this Journal was first founded, I had the honor and the sorrow to announce the presence in this Colony of the notorious gall-worm *Tylenchus* (or *Heterodera*) *radicicola*, Greef., an insidious and destructive pest, inhabiting the soil, and attacking the roots of a great variety of plants, and causing damage in many respects comparable with that produced by phylloxera. Since that time I have found that this worm occurs in at least all the Australian colonies except Tasmania. Having examined specimens from various parts of these Colonies, I am in a position to say that it is on the high road to occupancy of the whole continent. Its ravages are so hidden from sight and of so strange, and to the ordinary mind, of such inexplicable a nature, that it is, beyond question, already doing even greater harm than can be demonstrated by evidence. But when I say that I have collected, or received, specimens of the disease from a chain of localities extending from Bundaberg, in Queensland, to Adelaide, South Australia, I think I am making a sufficiently alarming statement.

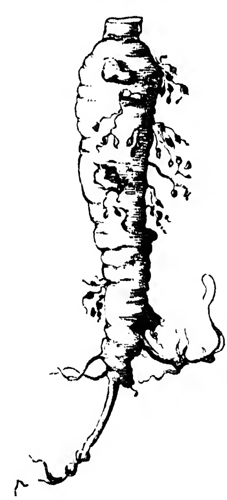


Fig. 48.—Parsnip attacked and deformed by root-galls.

Inasmuch as the original article on this subject is now out of print, I think it best to insert here a repetition of that part of the article that deals with the measures that may be adopted to hinder the progress of the disease. I am sorry to be unable to hold out any hope that the disease can be anything more than hindered, which is the saddest statement I have to make in all this long tale of disease and loss. Those who have their land

already so badly infested as to be almost unable to grow a decent crop of any sort will, I fear, be the only ones who will realise the full force of my words.

The nature of the disease caused by the gall-worm will become clear as soon as the diseased tissues are carefully examined. Fig. 49 represents a portion of a diseased parsnip rootlet, considerably magnified. The two swellings have been caused by, and contain, the gall-worms. Between the swellings the rootlet retains its normal size and structure, except that some modification may occur through sympathy with the diseased part. If a thin section of the undiseased part be examined, it will be found to present the usual structure. Beneath the epidermis of the rootlet lie cells constituting the hypoderm, and in the midst of these is found a single large central vascular bundle surrounded by pericambium. The tissue of the central vascular bundle is made up of three portions,—the woody portion or xylom, having in the section the contour of an hour-glass or dumb-bell; the sieve tissue or phlöem, appearing in the section as two narrow crescent-shaped areas, lying between the two parts of the xylom and the surrounding pericambium; the cambium occupying the remaining space, *i.e.*, the two angles where the two xylom portions come into contact near the centre of the rootlet. If now a section of the diseased part of the same rootlet be examined, it will be found that the additional size is caused by an increase in the amount of each tissue, but particularly of those constituting the vascular bundle. The epidermis and hypoderm remain comparatively unaltered in structure, but have increased somewhat in amount. The central vascular tissue, on the other hand, is much altered. It is increased in quantity, and the vessels have become much distorted. Instead of continuing parallel to the axis of the rootlet, as they would normally do, the vessels have become twisted about, and are often found turned to one side or the other, passing sometimes in a radial direction, and even in some cases turning backward. Whatever portion of the tissue has been actually invaded by the worm is easily recognised by its yellow colour. In the majority of cases, according to my observations, it is the cambium of the rootlet that suffers the greatest destruction.

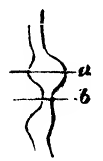


Fig. 49.—Portion of a rootlet of parsnip showing two galls, due to the attack of gall-worms. Magnified from Fig. 48.

The rootlets are the most fundamental organs of a land-plant. Upon them depends its supply of water and earthy material. Taking this fact into consideration, we shall no longer wonder after noting the changes wrought by the gall-worm, why so small an assailant can do so great injury. The plant is attacked at its weakest point. The tissues of one of its most essential sets of organs, the rootlets, become aborted. The absolutely essential food due the plant from the soil is cut off, and unable to live upon air alone it dies.

Let us now turn to the disease as manifested in the potato. Fig. 50 represents more or less spherical growths which appear in the substance of attacked potatoes. These growths seem always to be connected with distorted vascular tissue. They are found to vary much in size, and there seems little doubt that the "knobs," characteristic of the disease as it appears on the potato, are the result of these small beginnings. Each such body is composed of a thick outer wall, and an inner granular mass.

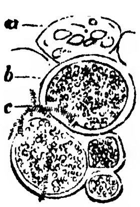


Fig. 50.—Tissue of potato magnified 40 times. *a*, cell containing starch grains; *b*, spherical growths seen in potato attacked by gall-worms; *c*, vesicular tissues.

These appearances in the parsnip and potato lead me to suspect that the abnormal growths caused by the gall-worm are probably to be compared to the galls produced on leaves by various insects. It is well known that leaf-galls are caused in the first place by a disturbance of the vascular tissues. The gall-producing insect commonly pierces a vein of the leaf with its ovipositor when depositing its egg. It is a common belief that the gall appears in consequence of a fluid injected by the insect at the time of laying the egg. I do not know whether this belief is supported by any good evidence. Possibly the mere irritation of such a foreign body as the egg of an insect or the wriggling larva hatched from it may be sufficient to account for the growth of the gall.

If I am right in comparing the swellings produced by this nematode to the leaf-galls produced by insects, then the former should be called root-galls, and the nematode itself may appropiately bear the name of the gall-worm. Dr. Neal has called the disease, as it appears in the United States, the root-knot disease. His name can have no referance to knots, the places where branches originate, otherwise it would be entirely inappropiate, but it refers to the characteristic appearance produced by the disease on rootlets which has been compared to the appearence of a thread with *knots* tied in it. The German name for the disease caused by *Tylenchus Schachtii* is Rübenmüdigkeit—that is, turnip-lassitute or beetroot-lassitute, referring to the tardy growth of the diseased plants. I believe both these names will be supplanted by the simple term "root-gall" (Wurzelgalle), which may be thus defined—abnormal growths on roots and rootlets, caused by the attacks of gall-worms.

Historical.

It is not until within recent years that we have arrived at an accurate knowledge of the habits of the gall-worm, although the disease root-gall has been known for a very long time. How long root-gall has been recognised as a distinct disease of the sugar-beet of Europe I am unable to say, but that it is very many years is certain. The root-gall of the peach has, according to Dr. Neal's exceedingly useful pamphlet, been known to the white people of the South Atlantic and Gulf States of America since the earliest settlement of the country; and, according to the same authority, reliable agriculturists state that the disease is indigenous there, they having seen it in places where neither trees nor plants had ever been introduced from other sections. The disease is now known to occur in North America on a belt of land 150 miles wide, extending from Texas along the Gulf of Mexico and Atlantic coast northward to the January isothermal of 50° Fah. According to the best testimony yet obtained, the peach-tree formerly grew on this area with no other disease than the borer, except in damp localities; while now in many places, owing to the prevalence of root-gall, the trees that do well are the exception. This fact shows how the disease has spread, or at least increased, and should serve as a warning to Australians.

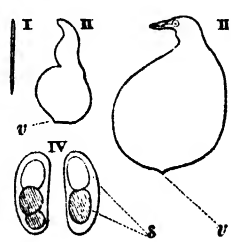


Fig. 51.—Gall-worms, taken in different stages, from the interior of a potato. I, young worm; II, female becoming gravid; III, full-grown fertile female; IV, eggs in two first stages of segmentation; v, vulva. I, II, and III are magnified 25 times; IV is magnified 100 times.

In the United States the plants that have been found to be attacked by *Tylenchus arenarius* of Neal, which is the same as the Australian worm, are as follows :—

Badly affected.—Roots of cabbage, kale, potato, banana, radish, okra, pea, peanut, cow-pea, bean, squash, pumpkin, melon, cucumber, tomato, beet, plum, apricot, peach, almond, fig, English walnut, willow, gourd, bigonia, sunflower, amaranth, dahlia, koniga, iberis, coleus, achyranthes, purslane, sand-purslane, verbesina, worm-wood, Jerusalem-oak.

Slightly affected.—Roots of cotton, egg-plant, pepper, spinach, cassava, maize, orange, grape, mulberry, walnut, pecan, hibiscus, ice-plant, parlor ivy, morning-glory, nolana, petunia, boussingaultia, spirea, flowering almond, buddleia, cape jessamine, shepherd's purse, blackberry, dewberry, eupatorium, cypress vine.

These lists include the majority of the most useful food-plants, many ornamental plants, and a number of the commonest weeds. Among the latter, the roots of purslane, amaranth, Jerusalem-oak, and worm-wood harbour the greatest number of worms.

The extent of the damage done by gall-worms is difficult to estimate. Much land in Europe has become so badly infested that certain crops—for example, sugar-beet—have had to be abandoned altogether. Not a beet-root will mature. The plants break the ground, languish a few weeks, and then die. Since time immemorial, crops of various kinds have died suddenly—so suddenly, Dr. Neal remarks, as to justify the expression, "struck by lightning." The unknown cause in some such cases has probably been the gall-worm. Many an agricultural or horticultural failure attributed to the use of improper fertiliser, to poor soil, or wrong cultivation, has been due to this insidious foe attacking the very fountain-head of vegetation. Were it possible to sum up in pounds, shillings, and pence the damage done by gall-worms, the total would probably amount to a fortune for a nation.

Remedies.

All that can be done in combating root-gall must be directed toward prevention. Once the gall-worm gains access to the roots, the game is up. A leaf-destroying pest may be dealt with even after its attack has made some progress, but thus far, at least, roots and rootlets are inaccessible except at the expense of the life of the plant. Hence it follows that all rational remedies for root-gall must be directed either toward ridding the soil of the gall-worms, or toward putting such obstacles in their way, or so reducing their number, as to render their ravages bearable. These ends have been sought in various ways.

1. By the use of some chemical, preferably a fertilizer, which will destroy the free-living larvæ.
2. By the selection of varieties not subject to root-gall.
3. By trapping the worms and thus removing them mechanically from the soil.

I shall consider the last of these methods first.

1. *Trapping.*—It consists in actually capturing the worms and then killing them by hand or by machinery. How to capture a foe numbering millions and doubly masked by being invisible and being hidden away underground might well seem a puzzling question. How it was answered constitutes one of the interesting passages in the history of applied science. The gall-worm of the sugar-beet had long been known to be one of the worst pests of that crop. Various investigations were made and various remedies tried by those

interested in the sugar-beet industry, but to little purpose. Year by year the pest grew worse,—more and more land had annually to be abandoned by the beet-grower. At this point the philosophical faculty of the University at Leipzig offered a prize for the best investigation of the cause of the Rübenmüdigkeit. The prize was awarded to Strubell for an investigation whose results are detailed on page 170, Vol. I of the *Agricultural Gazette* of N.S.W., under the head of *T. schachtii.*

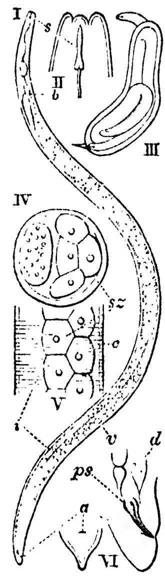


Fig. 52.—Male gall-worm. I, mature male, x 65; II, head of same, x 450; III, larval male, inside of its cast off skin, x 50; IV and V, cross and longitudinal sections, x 350; VI, lateral and ventral view of tail, x 225; *s*, spear; *b*, bulbs; *i*, intestine; *s z*, spermatozoa; *c*, cuticula; *v*, vas deferens; *d*, end of ejaculatory duct; *ps*, penes or spicula; *a*, anus.

Professor Kühn, making Strubell's investigations the basis of his reasoning, now devised a plan for trapping the larvæ. Noting that, according to Strubell's investigations, the larvæ on entering the young beet plant became mature in about five or six weeks, he predicted that if the plants were pulled at the end of four weeks, the worms in them would die without producing a new brood. It will be seen that Professor Kühn's plan was based on a careful perusal of the life-history of the *Tylenchus.* If the plant should be allowed to remain five weeks before being pulled, the *worms* would, it is true, be killed, but *not so the eggs which in five weeks the females would have produced.* These eggs would ultimately hatch and the pest continue. But after precisely four weeks, even the oldest worms in the roots would not yet have produced eggs, and, being at that time motionless sacs, incapable of boring their way out, must perish from starvation if the host-plant should suddenly die. In other words, Kühn proposed to make traps of the young plants, and naturally chose such plants as are loved best by the worms. Sugar-beet was selected as the plant likely to entrap the greatest numbers.

The result of the experiments based upon Kühn's plans was a brilliant one. A piece of ground, so badly infested as to be useless to the sugar-beet grower, was sown with sugar-beet. After four weeks the plants were pulled, and another lot of seed sown. The experiment was repeated a third time, if necessary, and it was then found that the pest was controlled. The time occupied was about three months. The plants whose roots were used as traps could be turned to account as fodder or fertiliser, so that the twelve weeks were not a dead loss. In Kühn's first experiments the plants were pulled by hand. That operation was expensive, and led to a trial of ploughing up the trap-roots, and this plan was found to answer almost equally as well.

It is beforehand to be supposed that the Australian gall-worm may be trapped in the same way as *T. schachtii*, but the time required for its development is not yet accurately known. I have no data for giving the *precise* length of time required for the larvæ to mature in roots. The most I can say is that it is probably less than that required by the sugar-beet gall-worm.

Consequently, in any trial of Kühn's remedy in dealing with the Australian gall-worm, it will be best, in the present state of our knowledge, to keep well within his limits and allow (say) three weeks before ploughing up the trap-roots. Mangels will make the best trap-root, and they should be sown thickly. Cow peas may also be tried.

2. *Gall-proof Varieties.*—Dr. Neal recommends, as a practically gall-proof stock for the orange, the hardy bitter-sweet or sour species, and, with some qualification, Citrus trifoliata, and the Japanese Unshin, or Satsuma; as a nearly gall-proof stock for the peach, seedling American wild plum or one of the Japanese plums Kelsey, Satsuma, or Ogru; as a stock for grapes perhaps the *cordifolia* or *vulpina* races. For other plants subject to root-gall he found no resistant stocks.

Fire is a powerful destructive agent which may, in certain cases, be brought into play in combating root-gall. The larvæ of the gall-worm infest the soil to a depth of at least 2 feet, but by far the greater number are

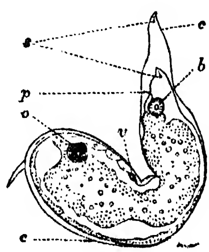


Fig. 53.—Moulting larva of a gall-worm, x 100; *c*, old skin; *s*, spear; *v*, ventral gland that emptied through the pore *p*; *b*, median bulb; *o*, rudimentary sexual organ.

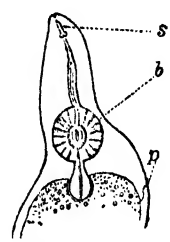


Fig. 54.—Neck and head of a gall-worm, x 200; *s*, spear; *b*, median bulb; *p*, excretory pore.

found within a few inches of the surface. The heat of a large fire will penetrate to this depth in sufficient degree to destroy life. This fact may be applied in setting out those trees particularly subject to root-gall, such as the peach, apricot, almond, plum, and fig. Nothing short of a large fire, lasting several hours, will kill the worms. The tree must be set in the midst of the burnt area, and no soil or fertilizer used except such as is known to be free from gall-worms.

3. *Use of destructive chemicals.*—Experiments looking towards the use of some fertiliser or chemical destructive to gall-worms have been made, and the results may be summed up as on the whole negative. No thorough-going chemical remedy for Rübenmüdigkeit has ever been discovered, although multitudes have been tried. Similar negative results were obtained by Dr. Neal in the case of his *T. arenarius*. Still the results are interesting, as pointing out what positively will not succeed; furthermore, they may be made the basis of plans for further trials.

Of all the vermicides yet tried, lime receives the highest commendation. It must be used in large quantities to be effective. (The same is true of the muriates and sulphates of potash and ammonium.) One to two tons of lime to the acre, applied, not all at once, but part in June and the remainder in October or November, may be recommended. The result is the destruction of a large number of worms; but many eggs, protected by the tissues in which they are being incubated, doubtless escape destruction, and live to propagate the disease. I have noticed that when the disease is combated with

chemicals, the method has been in all cases drastic, the attempt being to kill all the worms at one fell swoop. Possibly a homœopathic treatment would be more fatal. It is easy to believe that many of the experiments which have been tried were in reality effective so far as they went, although pronounced unsuccessful because the disease reappeared. My experiments have already shown that the period occupied by the development of the egg of Australian gall-worm may possibly extend over two months or more. While yet in the egg, the young worm is protected by the shell; and this protection is a good one. The shells of nematode eggs (as well as the skin of the larva when it is being cast) are comparatively impenetrable. Poisons which would at other stages of life be fatal, can therefore be withstood by embryos and moulting larvæ. I may support these statements, which are based on my own observations and experiments,* by the remark that the eggs develop in the very midst of decaying matter. The roots attacked by the disease die and decay, thus giving rise to chemicals of considerable strength and activity. Yet the eggs develop unharmed—quite likely, on account of the impenetrability of their shells. Now, suppose in some of the numerous experiments that have been made, all or most of the larvæ actually in the soil and unprotected were killed by the poison used. It is plain that the remedy was a good one, thus far; yet, if the eggs and moulting larvæ escaped destruction, because protected by their coverings, they would give rise to galls in the course of a few weeks or months, and the experiment would be pronounced a failure. I therefore repeat my suggestion that perhaps a more gradual and longer-continued treatment would be successful with some of the chemicals already tried and pronounced ineffective. Among those tried are kerosene emulsion; various solutions of arsenic; bisulphide of carbon; carbolic acid; the sulphates of ammonium, potash and iron; the sulphite, sulphide, and muriate of potash; hyposulphite of soda; tobacco dust.

4. *Frost.*—Dr. Neal says that if in places where the soil is frozen to some little depth each year the ground be ploughed at times during the cold season, it is reasonable to suppose that great destruction of the gall-worms will ensue. I know of no experiments demonstrating that the worms will not revive from the effects of low temperature, as they certainly will from those of long continued dryness.

5. *Drainage.*—It has long been known that drainage has an important bearing on the spread of *T. devastatrix*. Currents of water on or beneath the surface of the soil will pick up and transport small and light objects. Those objects of least specific gravity are most subject to the transporting power of water. Of all the constituents of the soil, none probably are more likely to be thus moved from place to place than minute organisms such as the eggs and larvæ of gall-worms; hence the great importance of drainage in connection with root-gall, as well as with the ravages of *T. devastatrix*. By a good system of surface drainage, surface-water may be so controlled as to spread the disease as little as possible. It is needless to go into particulars, as any farmer can easily devise a system of drains suited to his individual case. This matter must not, however, be overlooked by anyone whose land is infested. It is certain that water is one of the chief agents in the spread of root-gall.

6. *Famine.*—Famine is as destructive to gall-worms as to other animals, and there is not the slightest doubt that land kept quite clear of vegetation will, in time, become disinfected—the worms dying of starvation. How long a time would be required is unknown; probably more than a year. It is not

* For instance, I have observed that species which under ordinary circumstances are instantly killed by osmic acid may withstand the acid for an hour when moulting.

likely that land will be given up for such a length of time, especially when it is remembered that it must be kept clear of vegetation at considerable expense; but the fact that the worms may be starved out utterly, leads to the question whether or not, by a proper rotation of crops, they may not become so reduced by partial starvation as to become comparatively harmless.

The gall-worm evil, like most evils, is endurable so long as it does not become too great. It is only when the soil swarms with larvæ that serious damage is effected. Now, certain crops—for instance, maize and the cereals generally—are but little affected by root-gall. If land badly infested be planted with maize, it is reasonable to suppose that the effect will be much the same as if it stood idle and bare; but it is impossible as yet to say what value this method may have. Of course, this plan contemplates keeping the land absolutely free of weeds while it is bearing maize. The tough root of maize is not easily penetrated by the worms, and, finding no other plant to feed upon, they must, it would seem, of necessity starve.

7. *Use of non-infected Soil.*—When trees are to be set in infected land they may be filled in with earth taken from a depth of at least 2 feet. Such earth is practically free from gall-worms, and, if mixed with some artificial fertiliser known to be also free from them, will be found to answer the purpose well. This is a method recommended by Dr. Neal, though he cautions the gardener to beware using too much nitrogenous fertiliser, saying the vigorous growth thereby promoted is unusually subject to root-gall, because the root tissues are tender and therefore easily penetrated by the worms.

8. *Artificial Barriers.*—Another precaution which is of service in protecting young trees from root-gall is the use of artificial subterranean barriers. Having sterilised a spot of ground for a tree by means of fire, or by the substitution of uninfected subsoil, it becomes a question whether this now uninfested spot cannot in future be kept free from gall-worms, even though the surrounding land be infested. A means towards this end is the placing in the soil of a barrier or obstruction all around each tree, at a distance of (say) 2 feet from it. The barrier may be of staves placed close together in a circle, or, better, of old scraps of iron, such as old kerosene tins or old galvanised sheet-iron. Bark is an excellent and cheap material for the purpose. The barrier should be vertical, or slope from the tree so as to leave room for unobstructed root-growth. The purpose of such a barrier is evident at once. It prevents to a certain extent the entrance of worms from the outside infested soil. It will be effective in proportion as it is tight. Staves would therefore be less effective than old tin or iron in moderately large pieces. The latter, however, are much less likely to be at hand in sufficient quantity. Bark is probably about as available as any material. The pieces of bark should overlap each other. Of whatever material the barrier is made it should extend from a little above the surface of the soil downward at least 18 inches—better, 2 feet. Such an obstruction will, even if made of wood or bark, which will decay in the course of a few years, protect the young tree until it has attained considerable size and sent its roots deep into the ground. After that it is comparatively safe. Old trees with tough roots sinking deep into the ground suffer but little from the gall-worm.

Of course these barriers, even if watertight, will not prevent the entrance of the gall-worms spattered into the enclosed area during rains, or blown in as dust in dry weather. This fact points towards the usefulness of a mulch (uninfested, of course).

How does the root-gall spread, and at what rate? The disease will spread from a centre of infection at the rate of a few rods each year. In such

cases its progress is through the soil, and may be marked by its effects on roots. But infection does not always occur in this manner. During a spell of dry weather the eggs and dried up larvæ exposed on the surface of cultivated ground may be whirled aloft by the wind and scattered for miles over adjacent territory. The disease may thus unseen spread by leaps, making itself felt however in the new localities only after some years have elapsed, and the worms have become abundant by natural increase from the few eggs or larvæ deposited by the wind. These facts indicate sufficiently the rate at which root-gall may spread. The facts and rate are much the same as for *T. devastatrix*.

The different modes by which the disease may pass from one piece of land to another deserve careful consideration, for upon them are based a number of useful precautions. Some of these modes have already been mentioned incidentally, but the importance of the subject will justify dwelling upon them at greater length, even at the risk of some repetition. The migrations due to the animal's own muscular powers are not rapid or great. In fact they are so slight that I think it may be questionable whether they would account for any but the very slowest spread of the disease. Even when the worms pass from plant to plant in the same paddock it is questionable whether the movement is not due to transportation by some of the numerous agencies constantly at work in their neighbourhood. Almost everything that moves either in or upon the soil may transport the minute eggs and larvæ of gall-worms. Air, water, animals are all agents in disseminating the disease. The manner in which winds may act has already been alluded to, and some precautions, such as mulching, suggested. Under the head of drainage we have seen how necessary it is in combating root-gall to have an eye to the surface currents which during rains may pick the disease up as it were, and deposit it in mass elsewhere. The action of subterranean water has also been lightly touched upon. The general lay of the land determines largely the nature and direction of the currents in the soil. These doubtless have something to do with the spread of the disease. Here very little can be suggested beyond a proper system of drainage.

One set of agencies in the spread of root-gall, and a most important one too, has not yet received consideration. I refer to other animals. Insects, earth-worms, birds, domestic animals, man himself, are all factors in the life history of the gall-worm. Let the farmer who is fresh from cultivating his infested paddock show me his boot, and the chances are that I shall be able to remove from it small clumps of earth containing larvæ of the gall-worm. The hoofs of his horses are in a similar condition. If the weather is damp, it only needs a gun to demonstrate that even the feet of the magpie that followed the plough repeat on a smaller scale the same conditions. The insect that burrows in the ground and brings to the surface subterranean material is active in aiding the gall-worm in finding new pastures. The egg or larva leaves the mandibles of the insect only to be seized up by the wind, or be pressed with other matter into some crevice in boot or hoof, and thus, it may be, travel miles before being again set down. This is far from being a fancy sketch; every statement rests on the most unimpeachable observation. Even the hands when soiled from field work may carry enough material to start a thriving colony of gall-worms. It only needs to be washed off, and thrown with the water around roots of some favourite plant (to help it along, poor thing!), to form a nucleus for a new infested area. But enough has been said on this head to put those interested on their guard. The thorough cleansing of boots and hoofs before passing from infested to uninfested land is too obvious a precaution to need mentioning. There could be no more

appropriate closing statement to this section than that of the general principle that whatever moves and comes into contact with the eggs and larvæ of gall-worms is likely to afford them the means of finding new victims.

In addition to the foregoing, *I would caution agriculturists, seedsmen, and nurserymen against rearing, buying, or selling trees, plants, or tubers which show any swelling on the roots, except such as are well known to be natural to them.* I know of a case where this worm was introduced in seed potatoes, and I am confident that this is one of the common ways that this pest travels *en masse* from one district to another. Picture some poor fellow struggling to make for himself and a family a living out of the land. Deciding to try potatoes, he unknowingly secures a lot of seed infested with the gall-worm. Bear in mind that it is not uncommon for a potato to contain more than ten

Fig. 55.—A potato deformed by gall-worms. All the numerous lumps on the surface of the potato are caused by the gall-worms. This potato contained on a moderate estimate at least 10,000 eggs and worms.

thousand worms. Look at this ugly specimen! Every knob on its surface contains hundreds of worms! These he unsuspectingly plants, and (woe is he!) his land is permanently infested. After that, almost any crop he may try to raise will be more or less handicapped, and possibly ruined, as I have seen, and others can testify. *Closely scrutinise the roots of all the plants or trees you buy, and unhesitatingly refuse any that show galls.*

VIII. Diseases of the Grape.

Oidium is a disease well known to attack grapes at a time when they are as large as small marbles. That it may in some cases attack the fruit soon after it sets is not so well known. The accompanying figure shows a bunch of some grapes that set late, and so far as I could make out, were blighted at an early stage by oïdium. There had been no climatic or other known hindrance to

Fig. 56.—Bunch of grapes attacked by the disease oïdium. *a*, Berries with skin shrivelled by the disease; *b*, small berries also attacked by the disease; *c*, a berry still comparatively healthy.

development, and, moreover, the smaller berries were attacked by the fungus. This observation leads one to question whether we begin early enough in the season to apply our flowers of sulphur, the well known remedy for this disease.

IX. Disease of the Onion.

The flower cluster of the common onion is subject to the attacks of a disease that, though not identical with the black-rot of the tomato, is, at any rate, caused by a fungus nearly related to that causing black-rot, so similar that

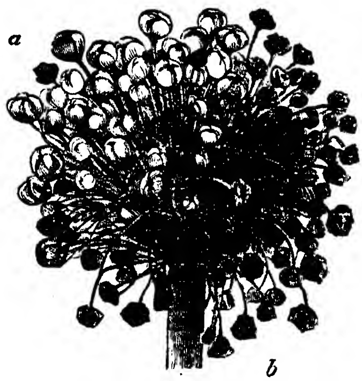


Fig. 57.—A disease found attacking the inflorescence of the onion. *a*, Healthy flowers; *b*, diseased and dead flowers. This disease shows itself by blackening and shrivelling the flowers so that they do not set. The cause of the trouble is a fungus similar in appearance to that causing the well-known black-rot of the tomato. The spores of the fungus are shown in Fig. 58. There appears to be two species here concerned, though but one is abundant.

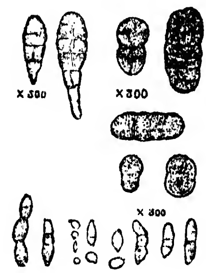


Fig. 58.—Spores of the fungus causing the onion disease shown in Fig. 57. The two upper left-hand spores are of a second species. The remainder appear to be those of *Cladosporium herbarum*.

I have felt justified in recommending remedial measures of a nature similar to those adopted for this latter disease. See Vol. V, p. 386. The nature of the onion disease is set forth graphically in the illustrations.

X. Timber Diseases.

Every year brings me a number of inquiries as to the cause of the death of the whole or parts of trees, generally fruit-trees, under peculiar circumstances, such as the absence of any apparent cause, or, at least, adequate cause. Sometimes the deaths are sudden, sometimes not; but in most such cases the disease has not been prolonged. These cases must not be confounded with death from lack of nourishment or care, or from old age. A tree in good soil, and hitherto vigorous, suddenly sickens and dies, or perhaps manages to hold out for a season or two and then dies; such is the typical case to which I refer.

In such instances we at once suspect one of two causes, namely, insects boring in the wood, or the presence of some timber-rotting fungus.

In the former case the death of the tree or branch is often sudden. The leaves wilt, dry up, and turn brown, as if a fire had scorched them, the whole operation sometimes occupying only a few days. If a limb be cut away and split up, the boring insects are usually disclosed. Their holes may also usually be seen on the surface. (See Fig. 59, front tree.)

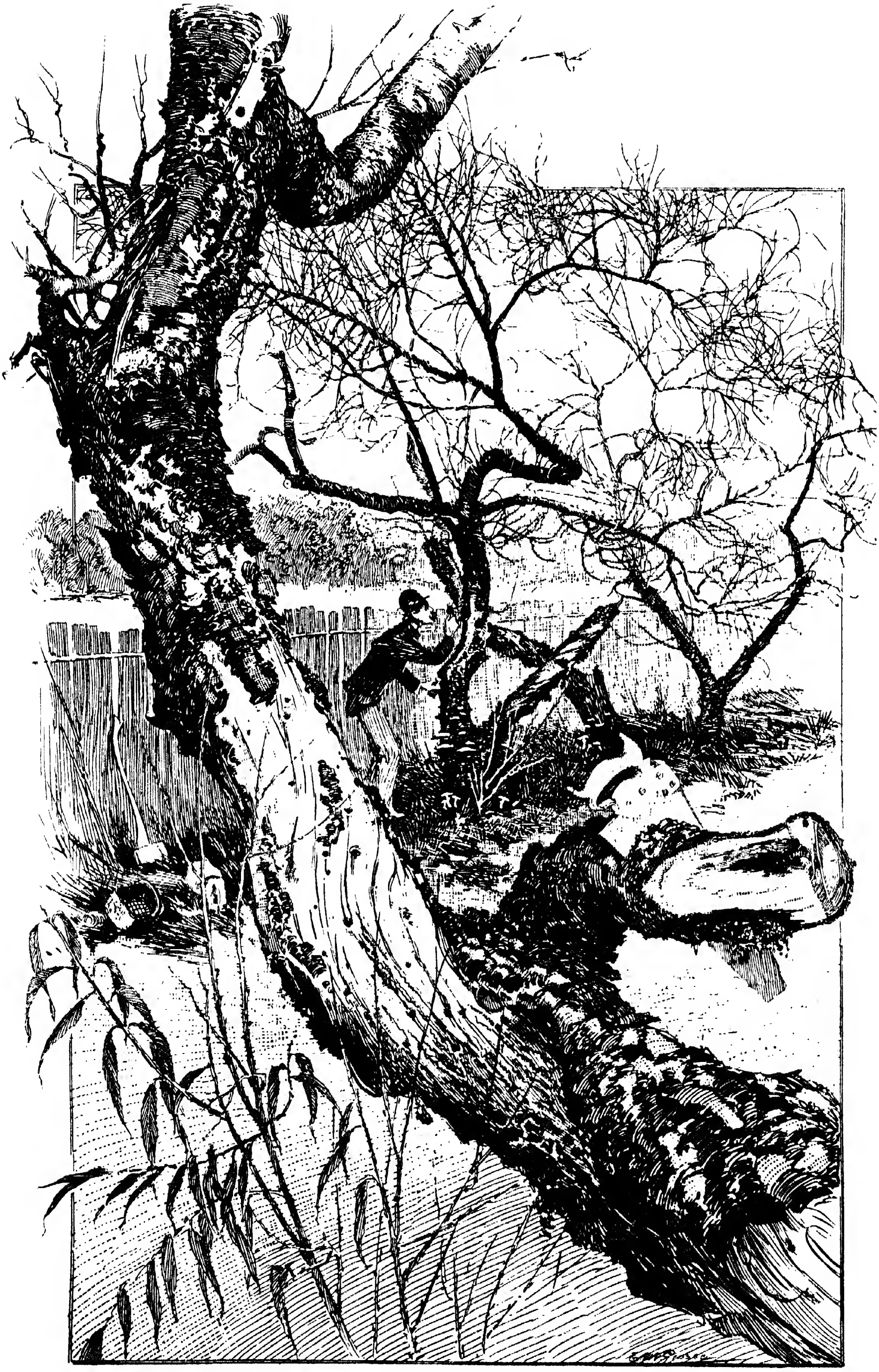


Fig. 59.—Peach trees suffering from the attacks of boring insects (cherry tree borer) and timber-rotting fungi. The front tree has been killed by the borers, whose holes can be seen where the bark has fallen off. The back trees show toadstools and bracket fungi near the base.

In the second case the death of the tree is usually slower, and the cause is commonly more hidden from sight. The wood of the dead tree, however, on being examined carefully, or compared with healthy wood of the same kind, exhibits the peculiarities well known to timber merchants and carpenters under the name of *dry-rot.* The diseased wood is softer and more brittle than sound wood, and differs also in colour, and finally becomes punk and falls to pieces. This deterioration is due to the presence among the fibres of the wood of the hyphæ or vegetative organs of a fungus whose fruit may sometimes be seen either growing out from the bark in the form of "shelves" or "brackets," or in the form of toad-stools near the base of the tree. Strange as it may seem, the microscopic "roots," as we may almost call the vegetative organs of these fungi, penetrate long distances into the solid wood of the tree, where, by gradually absorbing and changing the substance of the cells of the wood, they weaken it and give rise to the well-known appearance of dry-rot. The death of the whole or part of the tree follows as a matter of course. (See back trees in Fig. 59.)

Both these conditions may occur in the same tree, and it is therefore well to give as clear an idea as possible of the external appearance due to each of these diseases. The plate opposite (Fig. 59) gives a very good idea indeed of the whole matter. The insect attacking the peach-trees represented is the notorious cherry-tree borer, and is the larva of a night-flying moth, while the trunks of the back trees are represented as attacked by both Polyporus (bracket-fungus) and Agaricus (mushroom). The material for this illustration I obtained through the kindness of Mr. Devlin, of Estella, Wagga Wagga.

Remedies.

1. Trees dead or dying from either of these causes should be burnt. If there is reason to attribute the death to dry-rot fungi, the stump and main roots should also be destroyed by fire and the ground treated with quicklime.

2. Keep the place free from rotting and decayed timber. Such only forms a nidus, from which spring the spores of the dry-rot fungi.

3. Where timber-rot is prevalent, take the precaution to disinfect with tar the wounds on trees, either those caused accidentally or by pruning. In pruning be careful to use sharp tools, and to use them skilfully, and cut off the limbs close to the trunk or main branch that bears them, the idea being to give the tree a good chance to heal the wound as rapidly as possible. (See Fig. 23, p. 222.)

4. Remove superfluous bark, and whitewash the trunk and main branches. (See p. 222.)

5. Where a wound fails to heal over, and becomes a sore, cut away the wood as directed for *Mal di Goma* of citrus-trees. (See p. 229.)

6. Look out that the drainage is good. This is a most important precaution against timber-destroying fungi. Damp, ill-drained forest is their natural home.

7. As regards the remedies for borers, it is necessary to point out that they are, for the most part, totally different to the preceding ones, directed, as they are, against an insect instead of a fungus. It is when I observe remedies for fungi being applied to trees suffering from borers, and *vice versa*, that I realise how necessary it is to point out the possibility of being deceived as to the nature of diseases through resemblances such as have been described

in the preceding paragraphs. It is a waste of money and energy to apply the wrong remedies. It would be of little use, for instance, to apply fungicides to trees attacked alone by the cherry-tree borer, as in the case of the front tree in Fig. 59. On the other hand, where the trees are attacked by dry-rot fungi, it would be of little service to—

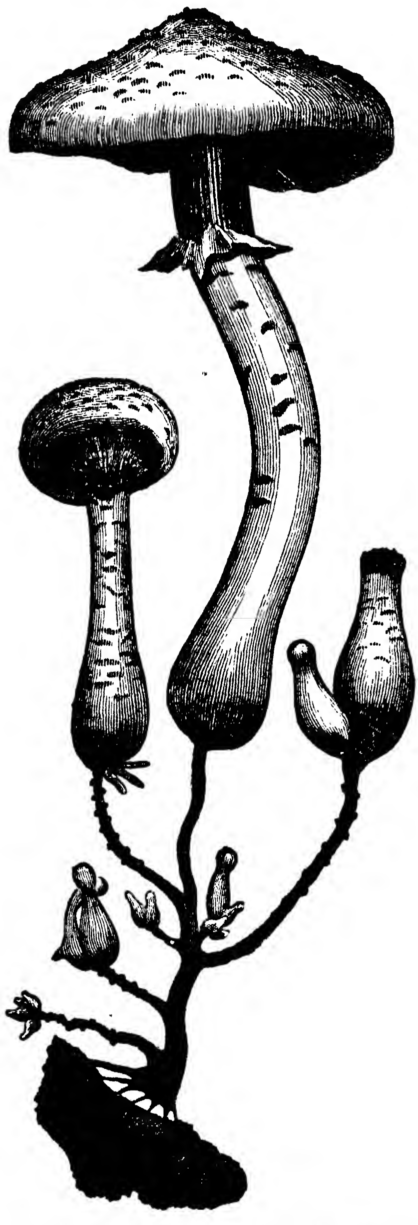


Fig. 60.—*Agaricus melleus*, one of the Mushrooms whose mycelium causes the decay of trees. After Hartig.

1. Remove from the vicinity of the orchard, unless they are serving some useful purpose, all sheoak, wattle, and other native trees that harbour the cherry-tree borer.
2. Spray the tree with tar-water, or some other substance that will be so offensive to the female moth that she will decline to lay her eggs there.
3. Remove loose bark, and whitewash the trunk and main branches.
4. Squirt or otherwise insert into all holes and crevices to be found, such liquids as kerosene emulsion or phenyl.
5. Set lighted lanterns at night, in the proper season, and so arranged that the attracted and dazed moths will fly against rags and dangling strings soaked in kerosene, or against some very sticky surface,—

for these remedies would be of little or no service against the dry-rot fungi, although effective as against the cherry-tree borer.

XI. Preparation and Use of the Bordeaux Mixture.

1. Preparation.

Where the Bordeaux mixture is in rather constant use it is a very good plan to keep its two constituent parts in solution, so as to be able to make fresh mixture expeditiously whenever it is required. The following suggestions will be helpful to this end:—

Sulphate of Copper Solution.—Fill a wooden upended cask nearly full of water, putting in (say) 40 gallons of water. Hang in this cask, just under the surface of the water, 8 lb. of sulphate of copper, done up in a piece of sacking. On the morrow the copper sulphate will be found to have dissolved, so that each 5 gallons of the water will contain 1 lb. of copper sulphate. Cover it well, and mark the inside of the cask where the surface of the solution stands, so that if, when the cask is next examined, the solution has somewhat evaporated, the requisite amount of water can be added to make up the deficiency. This is a stock solution to be kept on hand, from which to make mixtures as required.

Whitewash.—If quicklime be kept long in stock it "air-slakes," and this is undesirable, because the whitewash made from partly slaked lime is inferior. Adopt, therefore, the mason's plan of slaking a large bulk of lime and keeping the whitewash in stock. Slake the lime in the usual way while it is still all good, *i.e.*, freshly burned and "quick." Make a rather thick whitewash, of smooth consistency, free from lumps. Store this in an iron tank or large cask. As soon as it is poured in it begins to settle, and in a day or two the top part will be found to be quite clear. If the tank or cask be kept covered this subsided whitewash can be kept a long time, it being only necessary to keep the surface covered with water. Evaporation will take place and the deficiency thus created must be supplied by adding water from time to time. This is the second stock solution from which to make mixtures as required.

With regard to the first of these stock solutions the copper sulphate solution, I would remark that it is a matter of no particular consequence how much copper sulphate is dissolved *so long as the amount is known.* Thus if the orchardist prefers to make a stronger solution by dissolving 40 lb. of copper sulphate in 40 gallons of water, there is not the slightest objection, in fact there is some advantage, inasmuch as the solution will occupy a smaller space for a given quantity of the copper sulphate. The main point is to *know how much by weight of the copper sulphate there is in each gallon* of the stock solution when it is made.

Bordeaux mixture.—To make up a mixture from the two stock solutions proceed as follows: First decide what strength of Bordeaux mixture is to be made. Suppose it is decided to make a mixture that shall contain 3 lb. of copper sulphate to each 40 gallons of mixture, and the stock solution of bluestone contains 1 lb. of bluestone in each gallon of water. Take 3 gallons of the stock solution of bluestone (which of course will contain 3 pounds of the sulphate) and dilute it to about 20 gallons. Stir up the settled whitewash with a paddle until a smooth thin whitewash can be dipped out. Dilute this with water, making sure, however, not to dilute it so much that more than about 10 gallons will be required to combine with or neutralise the 20 gallons of copper sulphate solution. This is something that has to be learned by practice, but it is easily learned. Strain the whitewash if necessary, in order to remove lumps, but it ought

not to be necessary. Now add the whitewash slowly to the sulphate solution until the latter is neutralised, which can easily be ascertained by testing the mixture with a solution of ferrocyanide of potassium, a yellow crystalline salt to be had of any chemist. Buy sixpenny-worth—it will last a long time. Dissolve the sixpenny-worth of ferrocyanide of potassium in a tumbler of water and place it in a bottle. It will keep; be careful with it, however, as it is very poisonous if taken internally. The solution, if properly made, will be light straw-coloured.

To test the Bordeaux mixture so as to find out when sufficient lime has been added to the 10 gallons of copper sulphate solution, take a drop of the mixture on your finger and daub it on to a board, or better, a bit of white paper, and add a drop of the ferrocyanide solution with a finger of the *other* hand. If you have not added sufficient whitewash, the ferrocyanide will produce at once a red colour. Keep adding whitewash until the ferrocyanide just fails to produce at once or after a few moments a decided red colour. When that point is reached the copper sulphate is exactly saturated or neutralised by the lime of the whitewash. This is a better test than sticking in a knife-blade,—quicker and more decisive, and more accurate.

When the copper sulphate is just saturated you have a choice of adding more lime or not. In my opinion, for most purposes it is desirable to add as much lime again as has been added to secure the above test. But the addition of too much lime is not desirable, because you may by this means so dilute or cover up the copper compound as to render it ineffective.

It will be seen that in saturating the copper sulphate solution with whitewash, it is necessary to keep note of how much whitewash is added. This is done by the use of a quart measure. If no account is kept it will be impossible to tell how much additional whitewash to add.

The knife-blade test referred to above consists in thrusting a clean knife-blade or other piece of polished iron or steel into the mixture that is being made. If a deposit of copper forms on the iron after a minute or two, the sulphate of copper is not yet neutralised, and more whitewash needs to be added. This test is by no means so sure, or quick, or accurate as that with ferrocyanide of potassium, but it has the advantage of being nearly always readily applied.

Should too much whitewash be by accident added, so that on the first trial neither of the above tests (copper on the knife-blade or red colour with the ferrocyanide) can be secured, either of two methods can be followed—

1. Throw the mixture away and start again.
2. Add more copper sulphate solution until a red colour just begins to appear.

In this latter case, however, it will be essential to know just how much extra sulphate solution is added, so as to know how much to make the mixture up to finally.

It will probably be best for the beginner to begin in a small way, and if he overshoots the test, throw the mixture away and try again. All the difficulties (and even these are slight) are in learning how; once learned, this method of preparing the mixture is as easy as any—in fact, considerably easier.

We will suppose, however, that no accident has occurred, so that the 10 gallons of sulphate solution have been properly neutralised with whitewash, and that then as much again whitewash has been added. It now only remains to add water until the whole mixture is made up to 40 gallons, and we have a properly-made Bordeaux mixture containing in every 40 gallons just 8 lb. of sulphate of copper.

The advantages of this method of preparing the mixture are—

1. Expedition. It is the *quickest way* where the mixture is regularly used and is required from time to time through the season.
2. It is *accurate.* It does away with the uncertainty always connected with the strength of commercial quicklime.
3. It is the most *economical* way. No lime is wasted.
4. The resulting mixture will *always be the same*, and there will be no risk of "burning" the plants by spraying with a mixture too strong, or wasting time applying a mixture that is too weak to do any good. Both these mistakes are too common, and will account for the failures that are from time to time reported to me. Bear in mind that there is no doubt about the efficacy of this mixture in the cases where properly qualified men recommend it. All the failures, and I am glad to say they are comparatively few, arise from ignorance of how to make or apply the mixture.
5. Finally, the making of the mixture from dilute solutions gives a finer precipitate, which is more easily kept in suspension, and is *less liable to clog* the nozzle. Perhaps this ought to be made a little plainer. I will therefore put it this way: If 1 lb. of sulphate of copper dissolved in 10 gallons of water be neutralised by 1 lb. of quicklime in 10 gallons of water, the precipitate will be finer than if 1 lb. of sulphate of copper dissolved in *1* gallon of water be neutralised with 1 lb. of quicklime dissolved in *1* gallon of water,—even though afterwards the latter mixture be made up to 20 gallons, which is the same bulk as the first when finished; and, of course, if the precipitate is finer it will give correspondingly less difficulty in the application.

2. Compound Mixtures.

I now come to the question of mixing two of the different liquids used to combat insects and fungi. This is a matter that brings letters of inquiry from time to time. Suppose, for instance, there is no chemical reason why Bordeaux mixture, a fungicide, and the resin-soda compound, an insecticide, may not be mixed. Suppose, as is actually the case, that when those two liquids are mixed, each retains all its chemical properties, would it not be a saving to mix the two and apply both at once, and thus with one *coup* attack both insect and fungus pests? This is the question that has been propounded to me more than once, and has cropped up also in other parts of the world. This particular question, put by an inquirer, has been answered as follows:—

"You are quite right as to the weakening of each mixture by the other, which could, however, be compensated for by doubling the strength of each. The advisability or otherwise of using the two mixtures together is not yet fully settled by experimenters. To me the probability in this particular case (Bordeaux and resin-soap) seems to be that experiment will show the mixture to be inadvisable, (1) because the Bordeaux will be clotted into a more insoluble state by the resin compound, and (2) because the resin compound (which, as you know, acts partly by "sealing in" the scales and thus smothering them) will be converted into a less perfect varnish by the lime and copper compounds. Two separate sprayings, on the other hand, even supposing them to be different mixtures, will be high in effectiveness

for reasons set forth in the enclosed pamphlet, which has hardly even yet been comprehended by experts themselves.*

"To follow either of these, however, at once by the other will be a less effective way than to use them alternately at intervals of a few days. If you wish to use both on the same day, something must be sacrificed. That sprayed on first will have the best chance of doing good, and hence you must be guided by your particular circumstances; and if the trees are suffering most from insects use the resin compound first, while if they are suffering most from fungi use the Bordeaux first."

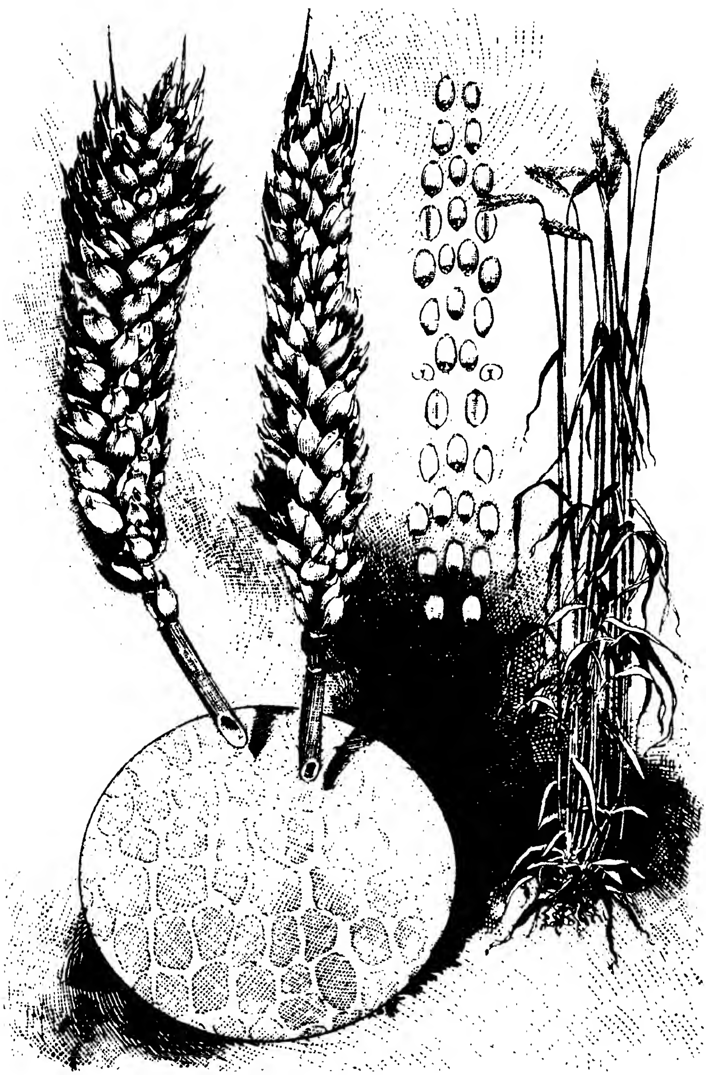
This answer is not meant to deny the possibility, or even the probability, that a first-class combined insecticide and fungicide may yet be discovered; it is merely an opinion based on experience with the two mixtures mentioned. It is well known, for instance, that Paris Green, applied to apple-trees, acts both as a fungicide on apple scab and as an insecticide on the codlin moth, and even when mixed with Bordeaux mixture, still retains its poisonous properties in an efficient degree.

XII. Miscellaneous.

1. Drying Fruit for Home Consumption.

Most of the Colonial literature treats the drying of fruit in such a manner as to imply that the application of the fumes of burning sulphur and other chemical treatments are essential and necessary parts of the operation. The following note to an inquirer throws light on a neglected phase of the question:—"I would like to add a few words about drying fruit for home consumption, as I understood you to say that was your object. You will notice in the book I lent you that a good deal is said about sulphuring and dipping in caustic solutions. Both these operations give a sample that markets better because it *looks* better, not because it actually *is* better. In fact both these operations introduce unwholesome elements into the dried fruit, and though it is to be admitted that the quantity is small, still it is there. Therefore, in drying for home consumption, I believe it wiser, and it is certainly cheaper, to omit these operations. A dark colour is not in itself unwholesome, and it cannot be disputed that the flavour of fruit properly dried without either of the above processes is superior to that obtained by their use. This advantage (for home consumption) more than counterbalances any darkness of colour. Drying for the market is different—more's the pity. There you must suit customers or fail in the business."

* Dialogue concerning the manner in which a poisonous spray does its work in preventing or checking blight. 8 pages, with 8 original illustrations in the text. *Agricultural Gazette*, Sydney, 1891.



RATTLING JACK.

THREE-FOURTHS FULL SIZE.

The circle illustrates the microscopic appearance of the so-called gluten layer.

Forest Moths that have become Orchard and Garden Pests.

By WALTER W. FROGGATT,
Government Entomologist.

The Australian Silkworm Moth (*Antheraea eucalypti*, Scott).

This fine moth is very common about Sydney, and has a wide range over the other colonies. The caterpillars feed upon the foliage of the eucalypts in their native state, and though they devour all kinds they seem to prefer that of the bloodwood (*Eucalyptus corymbosa*) in this neighbourhood. During the last few years they have taken to feed upon the somewhat similar aromatic foliage of the graceful pepper-tree (*Schinus molle*), which, introduced from South America, is so largely grown in our gardens and streets as an ornamental shade-tree.

The genus to which this moth belongs has a wide range, different species being found in Africa, Madagascar, India, Ceylon, Assam, Java, and Australia. Among these, the Japanese silkworm moth (*Anthraea yamma-mai*) is the best known, a coarse but very strong silk being produced from its cocoons. Four species are described from Australia besides this well-known one. The moths of this genus have a stout body, large wings marked with eye-like spots, and upon each side of the thorax are furnished with a stout hook sharp at the tip, which is used by the enclosed moth to cut its way out of the cocoon. Their legs are hairy, strong, and in the middle and posterior pair are armed with small spines on the tibiæ; the antennæ are beautifully toothed, those of the male forming a delicate curved feather, tapering towards the tips; that of the female moth is much longer and more slender.

They are allied to the beautiful Atlas moths of India and China, which differ from them chiefly in the smaller body, the vitreous eye-spots on the wings, and the prolongation of the extremity of their hind wings into spoon-shaped tails. One of these, the Ailanthus silkworm moth (*Atticus cynthia*), has been introduced, probably with its food-plant (*Ailanthus glandulosa*), into New South Wales, and is frequently taken in the Sydney gardens.

The Australian silkworm moth lays her eggs all over the bush in clusters of three or four creamy-white eggs flattened on the sides and rounded at the extremities. The full-grown caterpillars pupate in December. This brood produces fresh caterpillars which are full-grown and pupate in April; most of them remain in the chrysalis state through the winter. When first emerging from the eggs the little grubs are very dark-coloured, but by successive moults change to the beautiful dainty green tint of the full-grown larvæ. Each segment is encircled with six erect red tubercules or rounded spines tipped with blue, and sending out a star-like tuft of yellow spines, which can be expanded or retracted, reminding one of little sea anemones. There is a stouter tubercle towards the tip of the abdomen; the latter is produced into two strong claspers for clinging to the twig when feeding; above the legs runs a parallel stripe of light-greenish yellow.

The full-grown female caterpillar measures about 5 inches in length, the male somewhat less.

Though of such brilliant colours and large size, they harmonise so well with their surroundings that they are not casually noticed until their castings begin to accumulate under the tree, and its foliage begins to assume a ragged appearance. The caterpillar spins a large oval cocoon consisting of dark-brown silken strands closely matted together into a tough paper-like substance, smooth and shining in the interior, with the outer surface slightly roughened; they are often very cunningly hidden away in some angle of the branches or along the rougher bark, though some of them seem to be very careless, fixing the cocoon to any slender twig. The enclosed chrysalid is short and stout, broad at the shoulders, and rounded at the tip of the abdomen.

Mr. Ernest Anderson, in a paper in the *Victorian Naturalist*, 1894, gives a very interesting account of the manner in which the moth extracts itself from the stout cocoon. He noticed that when the moths first emerged, the curious sickle projections on the shoulders near the base of the fore wings were very prominent, but that as the wings dried and set these were hidden with the thick downy hairs from the shoulders. The moth, as soon as it escapes from the pupal skin, attaches itself to the top of the cocoon, and revolving round gradually cuts out a hole large enough to escape. This always takes several hours to accomplish, and anyone who has kept these cocoons to breed out the moths will have noticed the peculiar gnawing sound made by the moth long before she appears.

The male moth is a good deal smaller and more slender in form than the female, measuring a little over 4 inches across the wings, while the latter is often nearly 5 inches across the wings.

They vary considerably in colour from light fawn to bright reddish brown, and in some rare cases almost red in tint; a large peacock-eye in the centre of each wing—those upon the hind pair being much more deeply ringed with black than the fore pair; along the front margin of the fore wings there is a stripe of greyish brown thickest on the shoulders and tapering out towards the middle of the wing; a transverse stripe beyond the shoulders, a parallel one passing across below the eye-spots and crossing into the hind pair; there is a little angular white mark on the front of the wing before the eye-spots, and the tip of the fore wings are blotched with dull carmine; the hind wings have an irregular curved band across them behind the eye-spots, and the edges of both pair are marked with a slender dull yellow band.

Miss Ormerod in speaking about the Eyed-hawk Moth in England says, "it is objected to me by some of our entomologists that it is a pity to destroy the handsome and somewhat scarce insects," and in regard to destroying the larvæ of these fine moths I feel somewhat the same, but anything that becomes a nuisance must be kept in check and destroyed.

A spraying with Paris Green 1lb. to 100 gallons of water would soon destroy them, and any stray ones could be picked by hand.

The Banded Skipper (*Pamphila augiades Feeder.*)

Towards the end of last October, Mr. W. S. Campbell of this Department brought me several curious looking caterpillars with the information that they were numerous and very destructive to the foliage of some palm trees in his garden.

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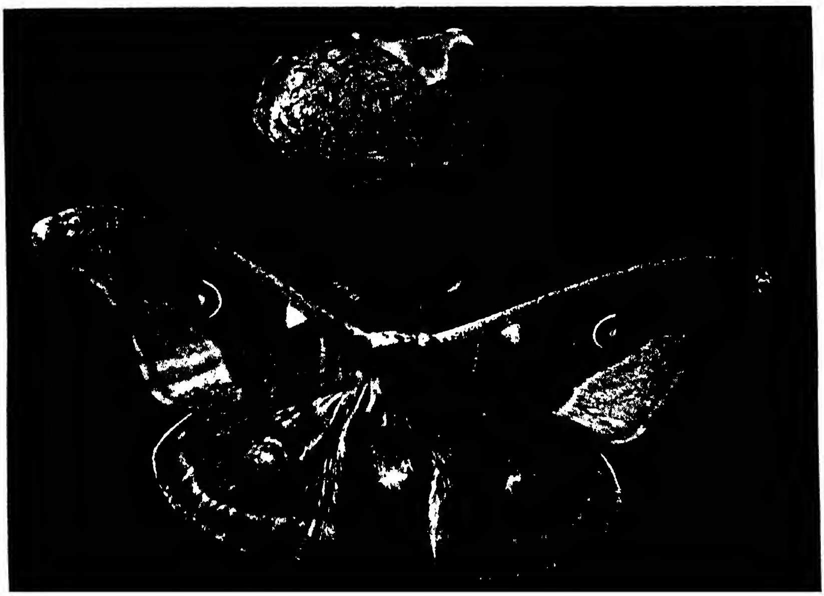

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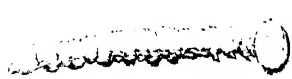
The Australian Silkworm Moth
(*Antheraea eucalypti*, Scott.)
1. Larva. 2. Cocoon. 3. Moth on



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The Palm Butterfly
(*Pamphila augiades*, Felder.)
1. Larva. 2. Chrysalid in leaf. 3. Butterfly.

I am not aware that the life history of this species has been recorded, but find that an allied species *Pamphila phineus*, whose larvæ feeds upon a native palm (*Livistonia australis*), has been figured and described in Scott's Australian Lepidoptera. The larvæ measures about an inch in length, with a large circular narrow brownish yellow head, flattened in front with a dark brown line running round the summit, and a V-shaped mark above the jaws with a smaller spot in the centre of the same colour. The base of the thorax forms a slender neck, swelling out behind and forming a slender cylindrical body with the segmental divisions very slightly marked, the legs small, the prolegs short and broad, and the whole of a pale greenish-yellow colour.

When full grown the larvæ draws up the edges of the leaf and curving them round fixes them together with several stout silken strands, and pupates in this primitive cocoon.

The chrysalid is light brown in colour, measures about an inch in length, slender and cylindrical, covered lightly with greyish hairs, and the abdominal segments distinctly marked, th anal one being flattened and rounded at the tip.

The butter-fly measures sixteen lines across the wings, the head and thorax very robust and the body tapering to the tip. The upper surface, eyes, and antennæ are black, with the centre of both pair of wings and the edges of the hind pair richly marked with rich golden yellow; the head thickly covered with reddish brown down; the down upon the thorax is reddish brown on the sides, and yellowish green in the centre; the abdomen is black, but thickly covered with golden yellow down; the whole of the undersurface golden yellow slightly blotched with black.

These caterpillars would not be easily found, but a light spraying of Paris green would rid the palms of their presence.

Bovine Tuberculosis

Its Introduction, Progress, and Dissemination in New South Wales.

(Read before the Veterinary Medical Association, Sydney, by the President, Mr. John Stewart, M.R.C.V.S.)

As the demands on our space are heavy, we are unable to reproduce the whole of this interesting paper. The unimportant portions are merely touched upon, but the more important are, however, given at length. The writer begins by calling attention to the wide-spread prevalence of tuberculosis in cattle. He then says that this is attributable to unnatural causes, because New South Wales, from its climate and the mode in which stud stock are kept, ought to be very free from the disease. He attributes the introduction of the disease to pedigree tuberculous cattle imported from England, and its dissemination in the Colony by the progeny of those tuberculous imported cattle. Of this he states that he has had personal proof, and that his own experience has been confirmed by information from Victoria. He proceeds to show how the disease has been still further disseminated by inoculating with the virus of pleuro-pneumonia taken from cattle affected with tuberculosis as well, and as this is the most important portion of the paper we have given it *in extenso*, with the proposals Mr. Stewart puts forward.

The writer says:—Having thus recorded the introduction and progress of bovine tuberculosis in New South Wales, we will now direct our attention to the method by which it is being disseminated among our cattle. I have to record that until about the early seventies *Phthisis pulmonalis* (now known as thoracic tuberculosis) was never met with in the common cattle of New South Wales, either by the slaughtering butcher or the veterinarian. I had exceptional opportunities of observation in this matter, inasmuch as in 1861, pleuro-pneumonia having spread over New South Wales as an epizootic, I had the honor of being appointed as a Government Inspector, with instructions to destroy all the diseased and suspected animals, for which 30s. per head was paid as compensation. I may here state that 30s. was a very fair sum at that time for an ordinary milch cow or store bullock, which tempted the owners of worn-out and unprofitable and starved animals to have them destroyed as affected with pleuro-pneumonia.

In all those which I directed to be destroyed, and they included milch cows, working bullocks, and station cattle, I made *post-mortem* examinations in the presence of my associates to verify my diagnosis, but in no case did I ever discover tubercular deposits on cutting into the lungs.

No doubt it is now a long time ago since these observations were made, and I am afraid we of the old school get but scant credit from what is now known as the up-to-date medical man, for knowing much about tuberculosis.

All the same, we could always direct the pathologist, the microscopist, and the bacteriologist, when, and where to find his game when he was on the hunt and had his gun.

With the continuous spread of pleuro-pneumonia, a new and increasing terror took possession of our herd-masters, more especially those who possessed commercial pedigreed stock, while there was not wanting numerous pretentious men of very little education, and certainly of no qualification, who gave forth to the world that inoculation with the serum taken from the thorax, or even part of a lung taken from a beast which had died of pleuro-pneumonia, was a certain preventive, if not a cure, for pleuro-pneumonia, and they passed on from station to station as "expert inoculators," operating at so much per head; and for a few years this was to them a very lucrative business.

As you can readily conceive, pedigree stock-owners hastened to avail themselves of the protection which inoculation was supposed to confer, with the dire results to their stock which I have already depicted. And so it came about, as time went on, in this way tuberculosis was promiscuously engrafted into our stock all over this Colony without a protesting voice being raised until 1890, when I was moved to pen a letter to the *Sydney Morning Herald* commenting upon a paragraph which appeared in one of our daily papers headed "Inoculation for Pleuro-pneumonia," which stated that during the past year inoculation was tried on 165 holdings in twenty-five districts, and in every case but one with good results, to which I replied: "But what was the nature of those good results we are left to conjecture; yet it does appear somewhat premature to form deductions upon such a short experience. All the same, in all probability a large majority of the flesh-consuming public will feel much comfort and reassurance on reading the above paragraph, as they are quite ignorant of the fact that some of the most eminent veterinary authors, high in place and practical experience, have stated that the matter of inoculation, as practised in cattle, brings about a diseased state of the blood, and that the effete matter becomes entangled in the meshes of the capillary vessels of the spleen, liver, and lungs, and this forms a nucleus for the development of tuberculosis." From the tenor of the above you will readily gather my object in penning it was to publicly protest against tuberculosis being disseminated by inoculation for pleuro; but I found myself to be as a man crying in a wilderness—none being found to hear or regard.

Now we have awakened to find that, comparatively, pleuro is nowhere and tuberculosis is everywhere.

In reference to our dairying cattle in the urban and suburban parts of Sydney, on inspection they are visibly in good health, fair condition, and giving the usual quantity of milk; but on the application of Dr. Koch's tuberculin test, one is appalled at the number which react in temperature, and not a few have distressed breathing with other constitutional disturbances.

Although my mind was quite prepared to find a large number suffering from what I may term latent or attenuated tuberculosis, I was shocked to find how universal tuberculosis had become in our dairy herds; so much so, that in my mind it is necessary for the present for legislation to insist upon the tuberculin test being applied to our milk cows. Having a strong suspicion that all the cows tested by us had not come by this disease in a natural way, I set about making inquiries, and found that about the middle of last year pleuro-pneumonia had prevailed at the places already indicated; that when a cow died all the others were inoculated from it, the operation being performed sometimes by the owner and sometimes by a knacker, who is said to be a "boss inoculator." Some of the cows died, a few lost part

of their tails, and the milk supply was kept up by purchase; and this, I am told, is the way in which most dairymen protect their stock against pleuro-pneumonia.

I take it that I have read to you the riddle, as it presents itself to me, of how bovine tuberculosis became introduced, progressed, and is disseminated in New South Wales. In the lay mind there may be a difference of opinion on this subject; but I think it will be conceded by all medical men that it is a reproach to our intelligence as a people, that while we have had for many years an organized system of meat and milk inspection, for the detection of tuberculosis, yet we have put forth no effort to fight this fell disease at its fountain head, and so cut off the source of supply. Needless to say, the object which impelled me to avail myself of the privilege of placing this subject before you for discussion, was the desire to obtain your combined knowledge and deliberation in constructing a scheme of campaign to fight to extermination tuberculosis at its fountain head, and, by way of initiation, I propose—

1. That all cattle or pigs brought into New South Wales for stud purposes be quarantined and subjected to the tuberculin test by a veterinary surgeon.
2. That all cattle inoculated for pleuro-pneumonia, other than fat cattle destined for slaughter, be prohibited from entering New South Wales.
3. That the inoculation of cattle for pleuro-pneumonia be made a criminal offence.
4. That all bulls be prohibited from running on a common, unless they have successfully undergone the tuberculin test, performed by a veterinary surgeon.
5. That all persons suffering from consumption be prohibited, under a severe penalty, from living in or near a dairy, or living in or near a place where cattle or pigs are being hand-fed, or where milk is being sold to the public.

This I submit to you as a first instalment. Doubtless some will think I have missed the squatter's bull; but I know King Squatter—I know him well. He is a keen-witted business man; he may be led but never driven. Demonstrate to him that something will be to his advantage and profit, then it is as good as done.

All the same, I think a very grave mistake was made when the cattle dealer and the squatter were relieved from their just and righteous responsibilities for placing diseased beasts on the butcher's market.

We will now for a moment briefly contemplate the enemy—Tubercle bacillus—we propose exterminating.

It is well known and admitted to be so tiny that the naked eye cannot find it out; so fragile that the sun's rays destroy it; so helpless in locomotion that it depends on the passing breeze; and its saprophytic life verges on starvation and death.

When fortunate enough to find a host in the natural way, it must do so in numbers, and this is the reception it receives from the host, as described by an eminent author, who writes:—"If a perfectly healthy individual placed under favourable conditions as regards food, fresh air, and exercise, is attacked by the tubercle bacilli, the active vigorous tissue cells are perfectly competent to destroy any bacilli that make their way into the lungs or the pharynx or the intestines." From this it would appear that the natural

inherent powers of the animal are quite sufficient to exterminate tuberculosis if man would only give the animal fair natural conditions, and stop his blundering propensities.

And surely now is the time, in a young country like this, that has not yet become quite saturated with the complications of the old world, to fight bovine tuberculosis to its extermination.

The life of a milk cow or a bullock numbers but a few years, and if care be taken that bovine tuberculosis can only be contracted and disseminated in the natural way, then the guest will depart with its host, and bovine tuberculosis be a thing of the past in New South Wales in a few years.

Finally, may I express the sincere hope that the medical profession will combine with the veterinarian, and unremittingly exert themselves to bring about this much-needed and happy consummation.

With respect to the proposals which Mr. Stewart submits, there is no doubt that No. 1 will be generally approved.

With regard to No. 2, we do not see that such a proposal is practicable, as it would, if acted upon, exclude the greater portion of Queensland store cattle.

Concerning No. 3, we could not expect that owners would be induced to give up the practice of inoculating until the veterinarians and other scientists engaged in investigating this disease can recommend some better substitute as a protection against the ravages of pleuro-pneumonia, especially as the virus now used in Queensland, and a great deal also of what is used in this Colony, has been tested for tuberculosis by Mr. Pound, the Government Bacteriologist for Queensland, before it is sent out for use. If virus were taken from tuberculous cattle, it was done contrary to the directions issued for inoculation.

As regards proposal No. 4, we are in accord with Mr. Stewart, but would go further than he does, and recommend that all dairy cows and stud and herd bulls should be tested.

We also concur with proposal No. 5, so far as it is practicable.

As to the statement made by the writer that tuberculosis was not met with in the common cattle of the colonies until the early seventies, no doubt the disease is a great deal more prevalent now than at the period referred to, and this is unquestionably due to some extent to the use of tuberculous virus, but even then cattle with swollen glands, and what was termed "rot in the lungs"—actually true tuberculosis—were frequently met with.

An article on Dr. Koch's Tuberculin, by Mr. E. Stanley, Chief Veterinary Inspector, appeared in the *Agricultural Gazette*, Vol. VII, Part 7, p. 471.

Prickly Pears as Fodder.

W. L. BOYCE, Lochinvar.

I HAVE read with interest the article in the October, 1896, number of the *Agricultural Gazette* (showing the value of the prickly pear in Sicily), and the result of experiments by Mr. J. F. Gorus, of Eschol Park, Minto, and as you ask for information regarding the uses of the "pest" in this Colony, I have pleasure in relating my experience and experiments.

On the 5th January, 1895, a flood in the Hunter River destroyed all the standing crops here, and this being immediately followed by the drought that is still upon us prevented the growth of barley and all other winter crops. The winter of 1895, therefore, proved a very severe one, many cattle dying. The first of my cattle went down while there was plenty of dry grass, and the stock in fair condition; the cause of death being, I believe, inflammation of the bowels. Having no green stuff to give the poor brutes, I conceived the idea of boiling prickly pears, of which I had a fair supply but not sufficient to feed all the stock right through the winter. With the dry grass the cattle became bound and tucked-up like greyhounds. For the first two or three days the pears acted as a purgative, after that they kept the bowels nicely open; in a few days the bellies commenced to drop, and in from a week to a fortnight the animals looked round and full again, ready to be turned out in the back paddock. I fed the milkers for about four months.

To start the cows with the new food I added bran and salt, though I think this was hardly necessary, as you will generally find one beast in a mob ready to taste anything new, and the others soon follow. The cattle became so fond of the pears that they would in their impatience pick them up so hot that they would have to drop them again. The cows improved in condition, and their milk was good; one, in particular, who got more than her share, fattened on the pears. A large-framed cow that was very weak after calving, and could barely walk, recovered on this feed, and continued to milk for twelve months after.

Pigs also did well on the boiled pears alone. My neighbour saved his pigs by giving them a quantity of the wash from my pot every day. The balance of this wash or juice I poured into a trough for the cows, which drank it readily, although a good lagoon was alongside of them.

For a boiler I used a 200-gallon square iron tank, with a 17-inch manhole. This was set in a trench in a sloping bank, with a fireplace 2 feet wide by 18 inches deep underneath, and a flue 2 feet wide by 6 inches up the back; this gives a good draught, and the tank being half buried retains the heat.

About 9 inches of water in the boiler is sufficient. Fill up with pears—leaves, stalks, and all—in bunches as large as you like, and put on the lid as nearly steam-tight as you can get it. Make a quick, fierce fire, and the steam will cook the pears right to the top beautifully. The pears will soon settle down in the boiler, when more can be added.

I fill the boiler and fire up in the evening, and next morning find everything just right.

If it is desired to make two feeds of the one boiling replace the lid and the contents will keep warm for two days.

When cooked the leaves retain their shape and are easily removed from the tank with an ordinary pitch-fork, and can be thrown on the grass for the cattle.

Boiling or steaming renders the thorns and prickles soft and harmless.

Lest some may be tempted to cut the top off the tank, I will add that I have tried it, and find that it is necessary to confine the steam or else cover the pears with boiling water, which means that much more fuel will be required. It appears to me that the boiler above described is the handiest and cheapest thing for the purpose.

To make this article more complete, I have experimented and found that after steam is up any pears added will cook in thirty minutes, and I estimate that where pears are plentiful and fuel and water handy, one man with two or more pots could feed 200 head of cattle.

Last January I put into a stack of green maize and sorghum for ensilage twenty loads of prickly-pears; so far, everything is satisfactory, and I anticipate success. I will report results and forward you a sample in about two months' time, when I open the stack.

I have just started to boil pears again, and the cattle have taken to them readily without salt or anything added.

I have delayed this article to see my previous experience confirmed, and trust that those who have hitherto found the prickly-pear nothing but a curse may turn this to account, and in these times of drought, receive some blessing from the pest that is costing them so much to subdue.

In place of the noxious weed I intend to plant the large leaf, spineless pear.

Crossing Fowls for Market.

By J. J. McCUE,
Poultry Expert, Hawkesbury Agricultural College.

Before proceeding, I wish my readers to understand that when I use the word "crossing," I mean only first crosses—that is, you cross any two breeds for once, and not go on breeding and recrossing from the progeny got from the first cross.

The greatest need of the poultry business of to-day is an improved quality of product, both of eggs and market fowl. Few men have a fair conception of the influence of quality on consumption, and yet it is highly improbable that the glutting of our markets with an inferior or low grade of fowls checks the consumption of poultry products to a remarkable degree, and is a most serious handicap to the business. Another point, and that is, for farmers to try and place their products direct in the hands of the consumers.

There is no necessity to cross fowls for egg-production alone, for the simple reason you would gain nothing. We have plenty of good laying breeds—hardy and prolific—that no cross-bred can ever equal. Of course where egg-production and table qualities are required, some people say a cross-bred is the bird to fill the bill. Now, I beg to differ, for the simple reason we have so many new breeds that there is no necessity for us to go making new breeds on our "own hook"; but as many are great believers in crossing, I will give my opinion on crosses I have made and seen during the past twenty years.

1. Under no circumstances should we cross the male of a heavy breed upon the females of a lighter breed; always the opposite—the light male with the heavy female.
2. The best table fowls are Game, Dorking, Houdans, Wyandottes, Langshans, &c.
3. The best cross for laying and table—Houdan and Dorking, Wyandotte and Dorking, and Game and Dorking.
4. The best cross for table or market purposes is a very difficult thing to decide, for care, management, and climate makes a lot of difference.

The hardiest and best cross-breds I ever reared were Silver-grey Dorkings and Light Brahmas. This cross were fair layers, and grew to big weights at seven months.

Another good cross was Australian Black-red Game and Dorking. These mature quicker than Dorking cross Light Brahma, but are not so weighty.

A combination of eggs and poultry is the best plan to work on. Eggs should be made the leading factor, and market poultry next, when making any cross. We cannot get first-class layers and first-class market fowl from any cross; all we can do is get as many eggs as possible, as well as good market fowl.

Minorcas and Langshans are two good breeds to cross, the progeny being good layers and market birds.

A Leghorn male with Langshan hens is a good cross for eggs, and will give a quicker maturing fowl and greater layer than pure Langshan; but the fowls would be $1\frac{1}{2}$ lb. to 2 lb. lighter than pure Langshans when ready for market.

Brown Leghorns crossed with Australian Black-red Game produces a fair layer. The progeny will not have a mongrel look, being nearly of a same colour, but the Game will give size and flavour to the flesh.

The best cross for export, in my opinion, would be Game and Dorking—yes, and our Australian Game, too. I know my Indian Game friends will smile at that; well, I cannot help it. I have tried Indian Games many ways, and I cannot see where the extra qualities are, if any, that our Australian Game has not.

If England had had such a breed of fowls as our Australian Game when the first Indians were boomed, we would not hear so much of Indian Game crosses. Think, poultry breeders, and remember that English poultry breeders for the last fifteen or sixteen years have been reducing the weight of their Game fowls, and bringing them to a stage of fineness that they are merely tall, stilty, fleshless birds. The old English Game was a low heavy bird; but weight and quality were sacrificed for what?—long, lanky, ornamental birds.

English epicures always like the Game flesh, the old style English Games being delicious eating; and as these Games became very scarce of late years, Indian Games took their place as a crossing breed for want of a better Game breed.

To put the argument in a nutshell: cross Indian Game in any manner you choose, and Australian Game in the same manner, using good birds of each breed, and you will find a big disappointment with results from Indian Game—well, a disappointment at not finding all these extra qualities that Indian Game are said to give and other breeds fail in.

How many eggs will a good Indian Game hen lay in a season? Nothing near our despised Australian Game of good laying strain.

In conclusion, I wish my readers to understand that the foregoing is my humble honest opinion on a few crosses; and again state that I cannot see the necessity of crossing at all, for we have so many pure breeds to "fill the bill," either for layers, or for layers and market fowls. Years ago we had not so many pure breeds to choose from. Another thing, most pure breeds were delicate, and required an infusion of new blood; but late years brought so many different strains of each pure breed that there is no use of crossing into foreign blood for hardiness, &c. So where does the gain come in? Only to once more see the fowls of our childhood—mongrels.

The Influence of Bees on Crops.

By ALBERT GALE.

"You have a splendid crop, thank God," was once said at a harvest supper in the Old Country. "What do you thank God for?" was the reply. "Didn't I put plenty of manure in the ground?" If we were to put the question, "What are the chief necessaries in the production of your crops?" to all the Agricultural Societies in the Colonies, many of them would probably answer, "Deep and frequent ploughing, the loosening of the soil, keeping the surface well open, judicious manuring, good seed, freedom from weeds, and favourable seasons." No matter what branch of soil-culture an individual may be engaged in, or what crops he is growing, if he be market gardener, agriculturist, florist, or orchardist, the answer, perhaps not in as many words, would be tantamount to the same. The florist and orchardist would add pruning to their catalogue of the necessary requirements. There are tiny agents employed by nature that dwarf into utter insignificance all the modern implements of husbandry that are in use to ensure "an abundant and heavy harvest." They are seldom taken into account. These tiny agents are an absolute and concomitant necessity for the production of a crop from any member of the vegetable kingdom. The wind and insects are the agents employed for the fertilisation of crops. The two mentioned are the chief, but there are many others of a subordinate character that Nature frequently enlists to aid in the reproduction of the various members of her plant life. The members of Nature's great vegetable army, in regard to their method of reproduction, have two distinct characteristics by means of which they perpetuate their species and varieties, *i.e.*, some are termed flowerless and others flowering plants, *cryptogamic* and *phanerogamic* respectively. Ferns, mosses, seaweeds, &c., are included in the former, but this article has nothing to do with the reproduction of these cryptogamic plants.

Flowering plants, "the herb yielding seed and the fruit-tree yielding fruit after its kind, whose seed is in itself," are the portions of the subject I wish to deal with. How herbs yield seed, and how fruit trees yield fruit, appears strange, if we take into consideration the too frequent destruction of the very many agents, more especially the honey bee, that husbandmen in their blind ignorance are constantly waging war upon. "Smear the trees with poisoned honey," "Destroy the bees of the bee-farmer," or "Burn down the trees where there are bee nests," is the too constant advice given by well-educated fruit-growers, but whose knowledge of bee life is far below zero. Nature has been very lavishing in the distribution of her varieties of indispensable helpmates for the land culturists. The tiller of the soil, after the necessary preparation of the land and all the mechanical aids he brings to bear in assisting the earth to yield her increase, and to produce her crops of cereals, vegetables, and fruits for our imperative use, is solely dependent on

outside agents, over one of which he has little or no control. I refer to the wind. In insect agency—of these the principal ones are members of the bee family—he can to a certain extent regulate the supply and demand.

The chief agent employed in the fertilisation of the seed that supplies us with the "staff of life" is the wind. Seeds that are so fertilised are termed anemophilus. But life's luxuries—cherries, plums, and other drupes or stone fruit generally—are fertilised by insects; so are the pomes and all apple-like fruits, citrus fruits, berries, &c. Insects make the labours of the fruit-grower a greater certainty—make "assurance doubly sure." Without them all his labours would end in a wretched and miserable failure. We are entirely dependent on insects for the fertilisation of our fruit. Seeds or fruits that are thus dependent on insects for reproduction are termed entomophilus. It is a true and wise saying, "No bees no fruit." Nothing can be more fallacious than the idea that bees injure crops. There is no more widely entertained opinion amongst fruit growers and florists than this. Let a fruit differ somewhat in form, tint, flavour, or general appearance from that of the same crop on the same tree, the innocent bee is accredited with having "inoculated" that particular member of the fruit of that tree. I have heard it said, when examining the fruit on a navel orange tree, where the characteristic mark in some of the fruit was very prominent and in others almost inconspicuous, that the latter was caused by *bees*; and this, too, from men of prominent positions in the agricultural world. If an ornamental flowering plant produce a bloom differing somewhat from the rest of its kind, or sport, the bee is said to be the culprit.

Jam makers, during preserving seasons, very frequently when the bees come to clean up the waste syrup, and perhaps steal a little from that not found in the waste tub, cause by means of boiling water the destruction of millions of these tiny and industrious workers. Men do not understand that if they were to carry out this slaughter of the innocents with too high a hand, they would have little or no fruit to preserve. It may be interjected that butterflies, moths, beetles, and other members of the insect world fertilise our fruit crops as well as the bee family. True; but they leave behind them whole armies--well-drilled armies—of caterpillars, grubs, or maggots. These destroy the very fruit their parents fertilised, defoliate the trees, cause sickness inducing disease, and ultimately the destruction of the orchard. This cannot be said of the bee. Butterflies, &c., fly from tree to tree and orchard to orchard, laying a few eggs here and a few there. It is difficult to confine or introduce them to a district, and when once there it is a greater difficulty still to exterminate them. Insect fertilisers, other than bees, are nearly all solitary and houseless wanderers, and it is a work of patience and labour to mitigate their ravages, and the little good they may do as fertilisers is greatly counterbalanced by the great mischief wrought by their offspring. On the other hand, bees are social, are domestic, are under control, can be increased or diminished according to requirements.

The advent of a bee-keeper in a fruit-growing district is not a blessing in disguise, but a blessing so prominent that a traveller passing through a fruit district by express train during fruit harvest can always see the handiwork of the bee. The orchardist cultivates the trees from which the bees get their pollen and the bee-keeper his honey harvest, and the fruit-grower in his turn is almost entirely dependent on the bee-keeper for his harvest of fruit. Between bee-keepers, fruit-growers, florists, &c., there is a Mutual Provident Association so strongly united that to repress the former is to destroy the profits of the latter.

Another interjection : Have not the bees been the chief agents in the destruction of some of the best varieties of melons, pumpkins, cucumbers, and other members of Cucurbitaceæ or gourd order that have been introduced into this Colony? If by this it be meant that certain varieties of these very useful vegetables have entirely disappeared, and have been replaced by inferior ones, the result of cross-pollenization, the bee for a while must plead guilty, because the whole of the order cucurbitaceæ is entomophilous, and the bee plays the chief part in the cross-pollenization. The fertilisation of the whole of the gourd order is so easily controlled that the bee must be acquitted, although he has pleaded guilty, on the ground that the growers have wholly contributed to the result by their indolence, carelessness, or ignorance. A little ignorance in these matters is far more dangerous than the proverbial little knowledge.

In the next papers I shall show how fertilisation and cross-pollenization of the vegetable kingdom is almost entirely under control for seed purposes and the production of new and improved varieties, and of the infinite use of the bee in the fructification of crops.

(*To be continued.*)

Notes on Orchard Planting.

By W. J. ALLEN,
Fruit Expert.

As I have not been over the Colony of New South Wales, I am hardly in a position to know just what is required in the different districts, but those intending to plant this coming season should now be getting ready to do so, and it is to such I specially address my first few remarks in the *Agricultural Gazette*.

The first thing to be thought of is the soil, and in selecting this the planter cannot be too careful to see that he selects the best sort he can get, and that it is specially adapted to the trees or vines he intends planting, otherwise his experience will be a succession of disasters, as in the first place his trees will not thrive or grow as they should, and at the end of the third year, when he might expect them to bear a little fruit, the quality will be very disappointing. If he be an enthusiast he may not lose confidence, and will probably set to work and manure; but even with this he will find that he cannot make it pay, and indeed there are some soils, particularly in the mallee districts, that the most enthusiastic and intelligent fruit-grower will not be able to raise fruit on profitably.

Secondly.—The planter must choose only those varieties of fruits which have been found to be the most profitable and which thrive best in similar soil, exposure, and temperature in the particular locality where he is situated. For instance, whilst citrus fruits grow well in the Parramatta district and prove a profitable industry there, I could not advise planting them in places where heavy frosts are of frequent occurrence.

Thirdly.—When planting a commercial orchard it is important to avoid a multiplicity of varieties. Choose those best for either canning, shipping, or drying, it being absolutely necessary where the grower depends on his orchard for a living to keep this object in view, and not plant out a lot of rubbish which will have no commercial value.

The experience of hundreds of Mildura orchardists, as well as many in the Riverina district, compels me to speak rather strongly on these matters, as after watching and carefully tending the trees until they came into bearing, the fruit when it appeared was found to be worthless, and trees had to be re-budded, which meant a delay of another two years, and ruin to many.

Take peaches for instance—these are the trees which, in my experience, have proven the most deceptive; that is, there are so many worthless varieties that the purchaser can be taken in more easily with these than with almost any other fruit. From an inferior apple, cider could be made, but for an inferior peach there is practically no use.

The following, I consider, some of the best varieties for either canning, shipping, drying, or dessert:—Early Crawford, Elberta, Comet, Lady Palmerston, and, later still, the Salway—all of which produce medium to large

fruit—are good croppers and freestones, so that if the grower cannot sell his fresh fruit for canning or dessert it can be dried easily. The best early varieties for drying are the Elbertas and Early Crawfords, more especially in districts where the cool season sets in early, as they ripen in January and can thus be dried during the hottest season.

Among the best apricots for drying and canning are the Moorparks, Kaishas, Hemskirkes, and Royals. Ouillins Early is no longer considered one of the best for drying purposes as it turns too dark in colour, and also dries away too much, requiring 6 lb. of fresh fruit to make one of dried. The other varieties I mention dry a clear reddish-golden colour which presents a particularly attractive appearance, and they do not lose so much in drying. A trial shipment of these varieties sent from Mildura to London, some two years ago, was very favourably received there, several of the leading wholesale houses going so far as to say that if all the apricots grown in Australia, of equal merit and appearance, were placed upon the London market that the whole output would not equal the demand.

Apples.—Of these there appears to be an endless variety, and it behoves the planter to choose only such as are remarkable for their keeping quality, and of good appearance and flavour, and such as can compete favourably with those shipped by other countries to the London markets. In planting apples the grower will have more scope than with either peaches or apricots, both of which have to be handled as soon as ripe, and besides he has more well known varieties to choose from. Among those sent from Australia to the Home markets we find the following varieties brought the best prices, and were very highly commended, viz.:—Jonathans, Munroe's Favourites, Cleopatras, London Pippins, Rome Beauties, Stone Pippins, Perfections, Esopus Spitzenbergs, and Northern Spies. When planting, however, it is always desirable to put in about a dozen or so of assorted dessert trees of well known varieties.

In Canada where the farmer depends, to quite an extent, on his apple orchard as a means of revenue, particular care is given to raising this fruit, and only the best sorts are allowed a place in the orchard. These, when ready are graded, and only the finest fruit finds its way to the home markets, the smaller and inferior sorts being used either for drying or converted into cider.

Closely allied to the apple and ranking very highly among Australian fruits come the pears. Of these also there is an innumerable variety which multiplies with every year. The great difficulty to the planter, therefore, is to know which will prove the best commercially and at the same time be best adapted to his soil. The Bartlett, or Williams' Bon Chrêtien, stands easily at the head of the list if grown to a state of perfection, and is really the only pear now used throughout Southern California for either drying or canning. Other very good sorts, however, are the Winter Nélis, Vicar of Winkfield, Marie Louise, and L'Inconnue.

Oranges and Lemons.—If the trees have not been planted by the end of March or beginning of April, planting should be left if possible until about the 1st of November, when the first spring growth is over, as then they shift more easily and root action begins almost immediately. Still they may be moved with success during September, just before starting to grow.

It is very advisable that they be worked on either sweet or bitter orange stock, and 4 to 6 inches above ground, as they are very subject to collar rot, particularly when on common lemon stock. A young tree on the common lemon stock will grow more rapidly and probably bear a heavy crop earlier than those on the orange stock, but they do not last, and after bearing heavily

for a few years (maybe twelve or fifteen) the crop gradually becomes less, until finally the tree dies, whereas lemons and oranges worked on sweet or bitter orange stock and once properly established continue to bear to a very great age.

So far as Australia is concerned, the Lisbon lemon has proved most profitable, and, as a matter of fact, is the only lemon grown to any appreciable extent here, but as nurserymen have been working it on the common lemon stock for a long time past it has deteriorated to a certain extent. The Villa Franca is now pushing its way to the fore, and in colder and low-lying districts threatens to rival the Lisbon, as it stands the cold much better, particularly if budded on orange stock.

In treating of oranges I cannot too highly recommend the grower to plant only the very best to be had. These will always command the highest prices and find a ready sale. Washington Navels, Paper Rind, St. Michael's, Valencias late, Mediterranean Sweets, Homosassas, Beauty of Glen Retreat Mandarins, and Emperor Mandarins are especially desirable varieties commercially, but where the planter desires to put in only a few trees for home use I would recommend as well as the above Joppas, Maltas or Blood Oranges, Rios, Rubys, and Satsumas.

I consider that there are in this Colony some places where the raisin grape would do very well, and it seems to me rather a deplorable state of affairs that we should have to depend entirely on imported fruits so far as sultanas, currants, and raisins are concerned.

Plums.—I would not recommend the intending grower planting too extensively of plums which are not suitable for making a good dried fruit, as after the local markets for dessert and preserving plums are supplied he will find himself with a surplus on his hands, which, if they cannot be dried, will prove a dead loss to him. Prune d'Agen, Robe de Sargent, Giant Prune, and Italian Prune (Fellenberg) are all good varieties, and when properly cured make an excellent prune, but from my Mildura experience I could not recommend planting either Prune d'Agen or Robe de Sargent in the hotter districts, as these varieties will not bear so well where the temperature runs too high.

In conclusion, a few words of warning regarding the purchase of stock. Buy only from the nurseryman who has a reputation to lose, and not from the man who tells you confidentially he has "just a few left" of everything and anything you can name. Make your nurseryman guarantee that what he sells you is true to name and worked on the proper stock.

The reader must not think that because I have mentioned special varieties that they are the only good ones of their respective kinds, but in most cases they are the kinds which have come into high favour during the past few years.

Orchard Notes for May.

G. WATERS.
Orchardist, Hawkesbury Agricultural College.

THIS month the work of the summer fruit-grower will be approaching completion, though, in an orchard, work really never seems to be completed, all kinds of jobs arising from time to time. With the grower of citrus-fruit, his busy time is approaching, as the first of his crop—viz., lemons and mandarins—will soon be ready. Of course, in the early ripening districts, most of the fruit can be readily disposed of without resorting to storing. But though they probably will not be stored, yet I would impress upon growers the necessity for *cutting* the fruit, and not pulling it, as is usual.

If our growers would only give this method a trial, they would find that they would soon become expert at it; in fact, would, with a little practice, cut as many as they would pull, and I am sure there is no diversity of opinion as to which is the better method. Several growers to whom I have shown a pair of the Florida lemon clippers, have asserted, on trying them, that they could really clip more with such appliances than they could pull; and there is the additional advantage that the fruit is not touched by hand. Some have inquired why there is such an advantage in cutting against pulling? By the former method, the piece of the stem left practically leaves the fruit hermetically sealed. At the same time, I would impress upon those who intend clipping that they must be careful not to leave *too* much of the stem, as a stem that is too long would only bruise whatever fruit it came in contact with.

The exact method of lemon-curing has been described previously in the *Gazette*, so I need not repeat it here, but would refer readers to it. (Vol. IV, part 3.)

The Sicilian lemons have got such a hold upon the purchasers that, until such times as we market our fruit of an equal and made as presentable as theirs, we will not be able to drive them out of the market. The one very strong point in their favour in the eyes of the wholesale buyer or retailer, is that he can hold them so much longer in stock without their decaying. Of course, the fact that they can be landed here when ours are practically done is in their favour, but we must start, and that at once, to extend our lemon season. It is simply appalling to read the value of lemons imported into Sydney, and it will continue as long as our growers are content to put on the market fruit that sells for half-a-crown, or less, per case.

In the colder parts of the Colony pruning may be started towards the end of the month, as by getting this work done early you have ample time to carry out your spraying operations without being rushed, and it gives you a better opportunity to select nice suitable days for the work. In windy weather, for instance, spraying should be discontinued, as a considerable quantity of spray is lost. The old adage of "prevention being better than cure" is very

applicable at this time of the year where orchards have been badly affected by Shot-hole Fungus, Peach rust, Peach freckle, &c., it is advisable to give a good spraying this month with the Bordeaux mixture. The last-mentioned Fungus is rapidly spreading in this Colony, so every grower who has been troubled with it should not fail to spray, for if allowed to spread it will become one of our worst foes. The efficacy of spraying has been clearly demonstrated at the Hawkesbury College this year, for whereas peach-trees in the district surrounding were badly—and some very badly—affected, very little made its appearance this year. The strong solution, viz., 6 lb. of copper sulphate (bluestone) and 4 lb. lime to 22 gallons water, was applied before the buds burst in the spring.

Where old or dead trees are to be replaced in the orchard, they should be removed now, leaving the hole open so as to allow the land to sweeten; in fact where such is being done it is advisable to get a load or two of good sweet soil before planting the new tree.

Towards the end of the month trees can be planted in the warmer parts of the Colony, so that they will get good root-hold before spring.

Vegetable and Flower Notes.

Directions for the Month of May.

Vegetables.

If the less favoured districts but little gardening can be carried on, unless by the aid of irrigation, but the water supply is so extremely limited, and so little provision for bad seasons is generally made, that opportunities for irrigation do not often occur, except, of course, near permanent rivers or creeks.

If the soil can be worked at all, preparations can be made for planting and sowing when the rain falls.

Asparagus.—Prepare a plot of ground for this very useful vegetable. Trench and apply some rotted farmyard manure without stint, and towards spring the plants can be planted.

Artichoke Globe.—The best soil for this vegetable is rich sandy loam. If the soil is fairly moist plant out suckers in rows about from 3 to 4 feet apart.

Broad beans.—Sow largely during the month.

Beans, French, or *Kidney.*—Sow only in the warmest parts of the Colony.

Brussels Sprouts.—Sow a little seed and plant out any good strong young plants that may be available.

Cabbages.—Sow seed of two or three varieties to test most suitable for district. Plant out from seed-bed any strong young plants. When sowing seed avoid sowing too thick, or else the young cabbages will "run up" into objectionable spindly plants.

Cauliflower.—Sow seed and look well after it, for cauliflower seed needs more attention than cabbage, and does not generally germinate so freely. Plant out good strong young plants if available from former sowings.

Carrot.—Sow in drills about 1 foot to 18 inches apart. The seeds are apt to stick together, therefore they should be separated before sowing. Do not apply fresh manure for the carrot, but sow on ground that was enriched for some previous crop.

Celery.—Sow a little seed and plant out some strong seedlings. Use any quantity of manure for celery. Earth up advanced plants.

Endive.—Somewhat similar to the lettuce, and is used for salad. Sow a little seed, and transplant the seedlings when they are large enough. Make the soil rich with good, well-rotted manure.

Leek.—Sow seed, and plant out the seedlings when they are about 8 inches in height. Use plenty of manure, for the leek is a very gross feeder and must be well fed.

Lettuce.—Sow seed, and plant out strong young seedlings when available. This is a good time to sow and plant. Do not break any roots when transplanting. Use plenty of rich, rotten farmyard manure.

Onion.—Prepare a bed with care by trenching and heavily manuring with *well-rotted* manure. Be cautious not to use rank manure for onions. Drain well, make the surface fine, and sow the seed in rows and cover lightly with fine soil.

Parsley.—Sow a little seed.

Peas.—Sow seed from time to time in rows three or four feet apart.

Radish.—Sow a little seed now and then to keep up a supply.

Sea Kale.—Sow a little seed.

Shallots.—Plant out some cloves about 12 to 15 inches apart.

Herbs.—Sow some seed, and divide and replant old clumps.

Flowers and Shrubs.

Bulbs.—Plant out any kinds of spring flowering bulbs; for, though it is very late, bulbs planted this month will come on all right if a good season sets in. The most beautiful and best known of these bulbs are the daffodils and narcissus generally.

Camelias.—These shrubs are now coming into blossom. The buds should be carefully thinned out, with a view to improving the flowers. Some liquid manure given occasionally will benefit the plants very much. If the weather continues dry mulch the plants well.

Bouvardias continue to bear great quantities of flowers. Cut back the branches a little when the flowers have dropped off, and fresh shoots and flowers will be produced.

Annuals and Perennials.—Seeds of all hardy kinds may be sown, and young plants which have already come up may be transplanted or thinned out.

General Notes.

Canary Seed.

Mr. I. Jewell Rutter, Secretary Dowling Progress Association, reports:—On 24th July, 1896, I sowed at my place, Brighton Park, Milton, 1 acre of canary seed, 24 lb. to the acre, and sowed with a machine. It became a beautiful crop, and eventually was 4 ft. 6 in. high, very even and well headed. Not understanding the exact period for reaping, and believing it to be what is usually termed a catch crop—cut exactly at the nick of time, or lose the best of the seed—we reaped it the week before Xmas, and let it stand in the stocks for a fortnight; carted it in, and tried to thrash it with the ordinary flails; it did not thrash well, not quite dry enough. However, we thrashed about three bags (three bushel bags) of clean seed; I do not think we got more than half of the seed out; fed the horses on the straw; cut up a lot with chaff-cutter; horses devoured it with a relish, and refused oat chaff as long as they could get canary chaff and hay.

My son got a horse into form for the Agricultural Show ring on canary seed, chaff and hay, and he was admired by judges and the public.

Cows, I believe, would milk well on green canary.

Cost of seed, bought from local storekeeper, 4s. 6d. for 24 lb.

Linseed.

The following clipping from the Melbourne *Leader* may interest some of our readers:—"While the growth of flax for fibre is being attended to the simpler form of flax-culture for linseed should not be neglected, especially in connection with wheat-growing. Grown in alternation with wheat the effects are strikingly beneficial. One reason for this is doubtless the fact that a crop of linseed takes up a different set of soil constituents for its nourishment to that which cereals require. The effects upon a following crop of wheat would suggest that linseed exercises a positively fertilising influence. This effect is well known to some of the oldest wheat-growers of South Australia in a portion of that colony at one time famous for flax-growing, and these growers for many years resorted most successfully to the expedient of growing a crop of linseed as a rotation with wheat. 'We can always depend upon a good crop of wheat after linseed,' a South Australian farmer remarked to our agricultural reporter during one of his visits to that colony, and the remark induced a Victorian wheat-grower to try an experiment several years ago on a portion of his wheat-land which had become 'grain sick,' with the result that his experiment proved the crop to be peculiarly suitable to the districts north of the Dividing Range, so far as the production of linseed is concerned, although the length of stem required for a crop of fibre needs for its production considerably more care. If sown during April or early in May, at the rate of about a bushel of seed to the acre, it is ready for harvesting in October, before the hay or grain harvest sets in, and it stands the heat better than either oats or wheat. An ordinary yield is from 15 to 20 bushels per acre, and it can be harvested and thrashed in the same manner as wheat. Taking into account the value of linseed as a food in connection with our rapidly-extending dairying industry, linseed is deserving of more attention when its merits as a wheat rotation are proven in addition."

Replies to Correspondents.

During the last few weeks readers of the *Agricultural Gazette* have so readily responded to the invitation of the Department to bring under notice, for treatment under the above heading, matters of general interest, that up to date there are several thousand queries and suggestions to hand. Indeed there are so many important questions and valuable hints that it is difficult to know where to make a start. A few replies, taken haphazard, are given below, and by next issue we hope to have everything arranged so as to deal with the queries systematically.

Effects of Sorghum.

Mr. John Broderick, of Crookwell, states that two of his milking-cows died recently in less than an hour after eating Planter's Friend. The alleged poisonous properties of Planter's Friend, Early Amber Cane, and other varieties of sorghum have several times been referred to in our pages, and numerous instances have been quoted of cattle dying after eating these fodders.

Mr. George Valder, Manager, Wagga Wagga Experiment Farm, says :—So far as I can judge, death is not due to the sorghum, but to injudicious feeding. It has been well known for years past that it is dangerous to feed sorghum in its very young stage of growth to cattle, especially when they have been getting only dry food or are in very poor condition. If they are then run into a paddock of very young sorghum naturally they are inclined to eat too much of this sweet, succulent food, and therefore bad results follow. For the past three years the cattle at the Wagga Experiment Farm have been fed for fully nine months in the year on sorghum, either as green fodder or as ensilage. During that time I have not lost a single cow or calf, and our milk yield is far above the average. These results are, I consider, due to the following :—

1. The cattle are never turned into the sorghum, but a rough calculation is made as to the quantity required per diem, and every day that quantity is cut and fed to the cattle, care being taken that only as much as the cattle will eat readily is given.
2. On no account do I allow sorghum to be cut for fodder till it comes fully into ear.

Provided these directions were carried out, I am confident that such a thing as cattle dying from eating sorghum would never be heard of.

From experiments carried out here, it has been proved that in a dry season sorghum will produce nearly three times as much green fodder as maize, and therefore sorghum is undoubtedly one of the most valuable fodder plants that can be grown in this district.

In the *Agricultural Gazette*, September, 1894, appears the following paragraph :—" *Sorghum vulgare.*—The most peculiar of the diseases (?) to

which it is liable is that which makes the young stalks poisonous to cattle (in India), if eaten by them when semi-parched from want of rain. Of the fact there can be no doubt; their bodies become inflated after a meal of the young plants, and death ensues shortly afterwards."

Again this trouble arises from feeding young sorghum plants. I do not think for a moment that the semi-parched condition has anything to do with it, as during the past two years we have had to feed semi-parched sorghum to our cattle for weeks together, and yet they never showed any ill effects.

Some people are under the impression that it is only certain varieties that are injurious to cattle, but all the best known varieties have been grown and fed to cattle on this farm without any injurious results. As an instance of this, I may say that this season our dairy cattle have been fed on the following varieties, all of which were cut soon after they came into flower:—

Planter's Friend,
Early Amber Cane,
" Orange "
Black African,
M'Lean,
Dari,
Brown Dhoura or Egyptian Corn,
Yellow Branching or Milo Maize,
Red Kaffir Corn,
White "

The feeding of each of these varieties lasted for from a fortnight to a month, and therefore the test was a good one.

Potato Disease.

Mr. S. T. Sutcliffe, Rehoboth, Guyra, says:—"I treated my potato-seed this year according to Dr. Cobb's instructions, *Agricultural Gazette*, Vol. 6, Part 10, p. 729. I put them in new ground where no drainage from previously cultivated ground could get. I have not begun to dig them yet, so it is too early to state results, but I know that they are not free from scab. I think that the matter of potato-scab is of much importance. Potatoes are the staple industry of this district. I started three years ago with perfectly clean seed, putting the potatoes in each case into new ground, and they gradually got scabby and scabbier. Two neighbours bought some seed potatoes, and divided them. One had all his potatoes scabby; the other man's were clean. That was last year. A specimen of the scabby potatoes was sent to the Department. Dr. Cobb pronounced it potato-scab, and gave the remedy quoted above. Another neighbour of mine sowed new ground last year, ditto this year, and in each case the potatoes were too scabby to be marketable, whilst another old paddock that he sowed with the refuse scabby potatoes, in which no eyes were visible, and manured with droppings from cattle fed on unboiled scabby potatoes, turned out a crop of 30 tons of clean potatoes."

Dr. Cobb reports: "There is only one kind of potato-scab, and for that the treatment with corrosive sublimate (recommended in *Gazette* mentioned), if properly carried out, is a good remedy. There is, however, another disease of potatoes often confounded with scab, for which the above remedy would be of no use. I refer to the attacks of the insect known technically as *Lita solanella*, a moth whose larva bores its way into potatoes under the skin, and gives rise to appearances somewhat resembling scab, and often confounded with scab. Both diseases may, and often do, occur on the same

potato. It might be well to forward specimens (a label for free transmission is issued with this number) in order to determine whether the insect is not the cause of the trouble." (See also pp. 223, 224, and 225.)

Stunted Apple-trees.

MR. E. H. DAVIS, of Concord, says:—"I have Scarlet Nonpareil apples planted about four years. They have made very little progress, while other kinds, such as Mobb's Royal, Five-crown Pippin, and others on the same land and under the same conditions, have grown five times the size. What should be done—should I cut them down or bud them with the other kinds that are doing well? The land is dark loam for about 12 inches; then clay over shale."

The Fruit Expert, Mr. Allen, says:—"If, as report says, all the soil is similar in quality and Five-crown Pippins and other varieties make good progress in same while Scarlet Nonpareils do not thrive, there must have been something radically wrong with the trees themselves when planted. I take it for granted that the trees are all doubly worked on blight-proof stock; therefore the roots or stocks should all be the same, and should, when worked with Nonpareils, have made proportionate growth. The fault, therefore, must be either that when purchased they were not young healthy trees, but were, in all probability, small stunted trees of three or four years' standing, moved, most probably, from year to year to prevent growth; or else there may have been some chemical manure used in too close proximity to the roots, which will stunt and very often kill trees outright. The best thing to be done with these unhealthy trees is to root them out and replant with young healthy ones. It would not be advisable to bud on unhealthy stock such as is described.

Ringbarking Peppermint or Messmate.

MR. J. MORRISON, Bulga Creek, Queanbeyan, asks for information as to best time to ring or sap peppermint or messmate.

All authorities available appear to consider winter the best time. As a rule this tree suckers at all seasons of the year, but least in winter. An exhaustive report on Ringbarking and Sapping was published by the Department in January, 1894, and can be had on application.

Oil-cake for Draught Horses.

MR. ALBERT HANNABUS, Pitt Town Road, Windsor, inquires as to the feeding value of oil-cake for horses drawing heavy loads, such as teams. He feeds principally on maize and chaff, but believes some other fodder is necessary, as maize is too heating in summer time and oats are not always cheap enough. The oil-cake he refers to is sold by Messrs. Lever Bros. The Principal of the Hawkesbury Agricultural College is now conducting experiments with this cocoa-nut oil-cake for milk production, and when completed we shall publish the results. A little of the cake given to working horses would prove beneficial, but if fed too heavily it might cause looseness of the bowels and softness as regards work.

Watering Fruit-trees.

MR. MARTIN DUNN, of Forrester, *via* Windsor, inquires, "What quantity of water is required per acre for fruit trees in this district. Land well drained."

Mr. W. J. Allen, Fruit Expert, says:—"This depends entirely on the season of year, and in a very dry season three thorough irrigations should be sufficient provided the soil be kept clean, with deep cultivation, allowing no weeds to grow, and with at least two cultivations each month during the summer, and well ploughed in winter. If sufficient water to run in furrows is not available the best means is to make a small circular trench around each tree, and at a distance of 3 feet from it, and fill this up twice in a day, and as soon as dry enough loosen soil around tree well so as to retain moisture. This should be a sufficient supply to last six weeks in the hot weather. A 200-gallon tank, mounted on a cart and with a tap and canvas hose to run water from the tap into the trench, is the most convenient mode of carting water; the trench to be 6 inches deep. During the autumn, winter, and spring it is hardly necessary to irrigate, the season when trees most require water being after the ground becomes dry in the later spring and summer, and when trees are making vigorous growth."

Manure for Orange-trees.

Mr. Dunn also states:—"I have citrus trees (2 years old) on a ridge of sandy loam, and am putting vegetable drift soil from bank of Cuttin Creek as a fertiliser. Would like to know if this is sufficient in itself, or should I use a chemical or fertiliser with it."

Mr. Allen thinks it would be advisable to put with the drift soil 1½ to 2 lb. of Thomas' Phosphate Powder to each tree, mixed with the soil and well scattered about, but not within 2 feet of the tree itself. Oranges require fertilisers rich in potash, lime, and phosphoric acid.

Treatment of Hare-gnawed Trees.

Mr. Charles Smith, of Rossmore, Liverpool, mentions that in 1894 the hares ringbarked six of his apple-trees all around the sap and 14 inches in length. He bound the wounded stems with a bandage saturated well with clean tallow. The bark grew rapidly and very clean.

Fodder for Dairy Cattle.

In response to numerous inquiries as to suitable fodder for dairy cattle in dry districts, Mr. Valder states:—It has been proved at the Wagga Farm that, in spite of hot, dry weather, it is quite an easy matter to keep up a continuous supply of dairy fodder throughout the year. So far, the best results have been obtained from the following crops:—

For summer feeding:—

Sown in August—Sugar beet, mangels, lucerne.
,, September—Maize, sorghum, millet, lucerne, pumpkins.
,, October—Cow-pea, sorghum, millet, pumpkins.

For winter feeding:—

Sown in February and March—Turnips, rape, barley and tares, rye and tares, Poland wheat, and kale.
,, April and May—Lucerne, barley, oats, and rape.

In the intervening months small crops can be sown as the weather permits. The thing necessary to carry out the above successfully is to adopt a system of thorough cultivation by growing as much as possible in drills, and taking care not to sow until the soil is properly prepared to receive the seed.

If in the first instance the land is well and carefully broken up, the difficulty of preparation in unfavourable seasons will be minimised. It is also advisable to have a stack of ensilage on hand, in case of protracted drought, although so far I cannot say that is often required in this district.

The past two years have been, I am informed, two of the worst known by the oldest inhabitants of the district, and yet such crops of green fodder have been produced on this farm that I am satisfied dairying will pay here; and it is the intention of the Department to erect a dairy on the farm, and largely increase the dairy herd.

Lucerne.

Mr. W. C. Bowen, Manager, Walla Walla Station, *via* Culcairn, writes:—"A matter that I would like to know more about is lucerne. I have planted 800 acres of it, and have used the best Hungarian seed that I could buy. I have been told that colonial seed is far more satisfactory, being more vigorous in growth and more lasting. I would also like to know if there is any danger in keeping sheep on it for any length of time, as I have heard that young sheep have died through being fed on it. With us, I know it is not suitable for show sheep, as the wool gets in a very heavy condition, and when shorn is quite dingy looking. People hereabout say lucerne won't grow on clay lands, but I may state that I have seen heavy crops of it growing on railway banks in Tasmania that were pure pipe-clay. Possibly, the clay lands want subsoiling. With us, the land is light loam or sandy loam."

Mr. Valder, Manager, Experiment Farm, Wagga, reports:—"I do not think there is any objection to putting young sheep on lucerne, but of course keeping them on it for any length of time is a mistake—that is, if they get no other food. It is a very great mistake to keep any animals on one class of food for a long period, and although they often appear to do well, they would thrive much better if a change were given. Of course, this is often rather a difficult thing to do, but every effort should be made to carry it out.

"Clean samples of colonial grown lucerne seed, especially such as that produced in the Mudgee, Hunter River, and Tamworth districts, as a rule give better results than imported seed. I have several times seen them tried side by side, and in every instance the results obtained were greatly in favour of the colonial-grown seed."

AGRICULTURAL SOCIETIES' SHOWS, 1897.

Society.	Secretary.	Date.
Dapto A. and H. Society	A. B. Chippindall	Jan. 6, 7
Albion Park A. and H. Association	H. Fryer ...	,, 13, 14
Gosford A. and H. Association	W. McIntyre ...	,, 29, 30
Wollongong A. and H. Society	J. A. Beatson ...	Feb. 3, 4
Cobargo A., P., and H. Society	T. Kennedy ...	,, 16, 17
Ulladulla P. and A. Society	C. A. Cork ...	,, 16, 17
Berrigan A. and H. Society	R. Drummond...	,, 17
Riverina P. and A. Society (Cereal)	W. Elliott ...	,, ——
Manning R. (Taree) A. and H. Association	H. Plummer ...	,, 18, 19
Lithgow A., H., and P. Society	J. Asher ...	,, 18, 19
Robertson Agricultural Society	R. J. Ferguson .	Mar. 2, 3
Bega A., P., and H. Society	J. Underhill ...	,, 3, 4
Southern New England (Uralla) P. and A. Association	Jas. Leece ...	,, 9, 10
Tumbarumba P. and A. Society	W. Willans ...	,, 9, 10
Tenterfield Intercolonial P., A., and M. Society ...	F. W. Hoskin ...	,, 10, 11, 12
Coonabarabran P. and A. Association	E. May-Steers...	,, 11
Oberon A., H., and P. Association	A. Gale... ...	,, 11, 12
Berrima District (Moss Vale) A. H. and I Society ...	J. Yeo	,, 11, 12, 13
Cobargo A., P., and H. Society	T. Kennedy ...	,, 16, 17
Crookwell P. and A. Association	W. P. Levey ...	,, 18, 19
Lismore A. and I. Society...	T. M. Hewitt ...	,, 18, 19
Walcha P. and A.	F. Townsend ...	,, 23, 24
Cudal A. and P. Society	C. Schramme ...	,, 24, 25
Blayney A. and P. Association	J. Clements ...	April 1, 2
Mudgee A. P. H. and I. Association	J. Cox	,, 6, 7
Liverpool Plains (Tamworth) P., A., & H. Association	A. M'Leod ...	,, 6, 7, 8
Warialda P. and A. Association	W. B. Geddes...	,, 7, 8
Williams River A. and H. Association	W. Bennett ...	,, 7, 8
Cooma P. and A. Society	D. C. Pearson ...	,, 7, 8
Orange A. and P. Association	W. Tanner ...	,, 7, 8, 9
Gulgong P. and A. Association	C. E. Hilton ...	,, 13, 14
Queanbeyan P. and A. Association	W. D. Wright...	,, 13, 14
Royal Agricultural Society	F. Webster ...	,, 14-20
Moree P. and A. Society	S. L. Cohen ...	,, 21, 22
Clarence P. and A. Society (Grafton)	J. Wilcox ...	,, 27, 28
Bathurst P. and A. Society	W. G. Thompson	,, 28, 29, 30
Hunter River (West Maitland) A. and H. Association...	W. C. Quinton	,, 28, 29, 30
Hay Hortic. Society...	J. Johnston ...	May 5*
Namoi P. and A. Association (Narrabri)...	J. Riddle ..	,, 5, 6
Hawkesbury District Agricul. Association (Richmond)	C. S. Guest ...	,, 6, 7, 8
Upper Manning A. and H. Society	W. Dimond ...	,, 12, 13
Wellington P. & A. Society	R. Porter ...	,, 13, 14
Upper Hunter P. and A. (Muswellbrook)	J. C. Luscombe	,, 19, 20, 21
Gunnedah P. A. and H. Association	J. H. King ...	Aug. 3, 4.
Grenfell P. and A. Association	Geo. Cousins ..	,, 25, 26
Northern Agricultural Association	C. Poppenhagen	Sept. 1, 2
Murrumbidgee P. and A. Association (Wagga)... ...	P. W. Lorimer..	,, 1, 2
Albury and Border P. A. and H. Society	Geo. E. Mackay	,, 8, 9
Junee P. and A. Association	J. C. Humpreys	,, 15, 16
Burrowa P. A. and H. Association	J. H. Clifton ...	,, 16, 17
Berry Agricultural Association	A. J. Colley ...	Nov. 25, 26

Secretaries of Societies are asked to forward dates of forthcoming Shows as soon as decided.

* Postponed indefinitely on account of drought.

[10 plates.]

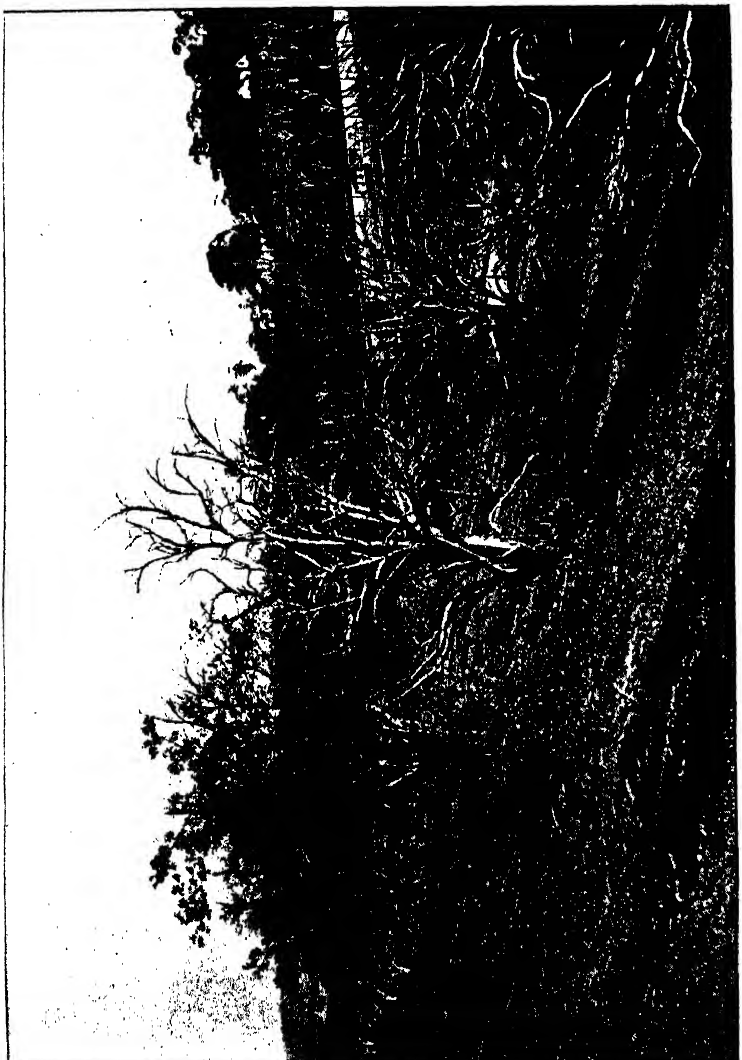


Fig. 1.—About 40 acres of abandoned, unfenced, dead and dying orange orchard, 9 miles north-west of Sydney.

The Abandoned Orchards of Cumberland County.

(All the illustrations are taken from recent photographs.)

By N. A. COBB.

A NEGLECTED orchard is a constant menace to all neighbouring healthy orchards—an abandoned orchard starts promptly on the high road to quick ruin. It at once becomes a breeding-place of all manner of pests, and from thence these pests continually invade all adjacent healthy orchards.

Fig. 2.—Ten acres of orchard, 12 miles north of Sydney. Unpruned and dying; choked with weeds.

Jones' Complaint.

Winds and flying creatures transfer the germs of disease from one orchard to another wholesale. Gusts of wind shake loose the spores of disease-producing fungi, and whirl them in among healthy trees half-a-mile away quicker than one can tell about it. Yon sparrow flitting from its nest among

the abandoned boughs across to neighbour Jones' beautiful peach orchard carries the dreaded aphis on his legs—only one or two of the insects, it is true, but that is enough, so frightfully prolific is the aphis. The flies and other insects that pass unseen to and fro are often laden with the spores of very injurious fungi. If Jones complains of all this don't set it down to an inborn tendency of his to grumble—he has a genuine grievance. He is trying to make a living out of fruit-growing, and he has such a hard time of it that if he makes both ends meet it is only by hard work and good luck.

But surely Jones must be an exception? Not every grower has an abandoned orchard abutting, and annoying him in this way?

I wish Jones *was* an exception, but so far as Cumberland County is concerned I am afraid he is not; in fact, I am sure he is not. No, Jones is not an exception.

Fig 3.—Five acres of orchard, 12 miles north of Sydney, abandoned, unpruned, and dying.

Take a Trip. See for Yourself.

If you doubt it take a 3s. trip to Hornsby, *via* Milson's Point, and return *via* Strathfield. The trip will take you through the heart of a large fruit district.

The North Shore railway train, running from Milson's Point to Hornsby, penetrates beautiful hilly country, containing some of the finest orchard sites in the Colony. Little slopes of excellent soil, having a protected easterly and northerly exposure, abound on every hand. Indigenous timber is abundant and tall, affording most perfect wind-breaks on every side. A husbandman's cottage, snugly tucked into a corner of one of these sites,

ABANDONED ORCHARDS OF CUMBERLAND COUNTY.

Sketches taken from Photographs, April, 1897.

Each Sketch is a fair sample of the whole Orchard.

surrounded by prolific fruit-trees, within 10 miles of half-a-million fruit consumers, presents to the imagination an ideal home and livelihood. As the traveller looks out of the car window upon such a scene, it is easy for him to envy the owner and occupant of this apparent earthly paradise; and yet, beautiful as these orchards appear, they are giving their owners a great deal of anxiety.

10,000 acres of Rotten Orchards.

Bad seasons, competition, poor marketing, pests—these are the drawbacks to the business. For some of these drawbacks the growers are themselves responsible, but over others they have only partial control, and among these

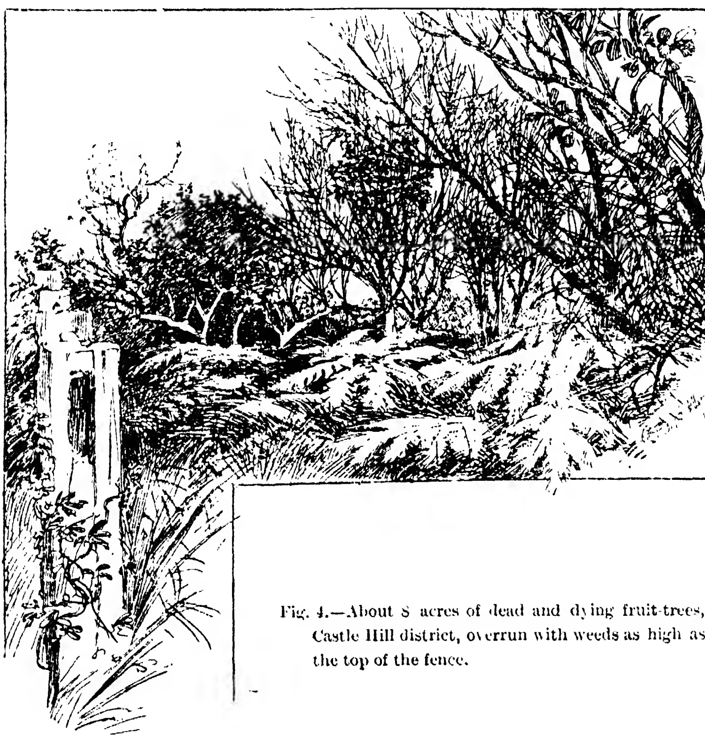


Fig. 4.—About 8 acres of dead and dying fruit-trees, Castle Hill district, overrun with weeds as high as the top of the fence.

are the various fruit pests with which they are afflicted. Though the orchardist may fight these by the best known methods, and for a time conquer them, they soon reappear, and the battle has to be fought over again. Clean his own orchard well as he will, there is at no great distance a breeding-place for all these pests, whence they make fresh inroads. Oftener than not this breeding-place is one of these numerous abandoned orchards.

Numerous? Yes, numerous! *Very* numerous! There is not less than 10,000 acres of abandoned and thoroughly diseased orchard within 25 miles of Sydney. Distributed in small areas of from 1 to 100 acres all through

our main fruit districts are hundreds of abandoned dying orchards. Across the face of this fair county of Cumberland, the pride of the Colony, is thus written in bold characters, acres broad, this criticism on our intelligence—that we will allow one citizen to palpably and seriously interfere with the legitimate occupation of another.

Hard Facts.

The case is a glaring one. Let us descend from generalities, and examine into details.

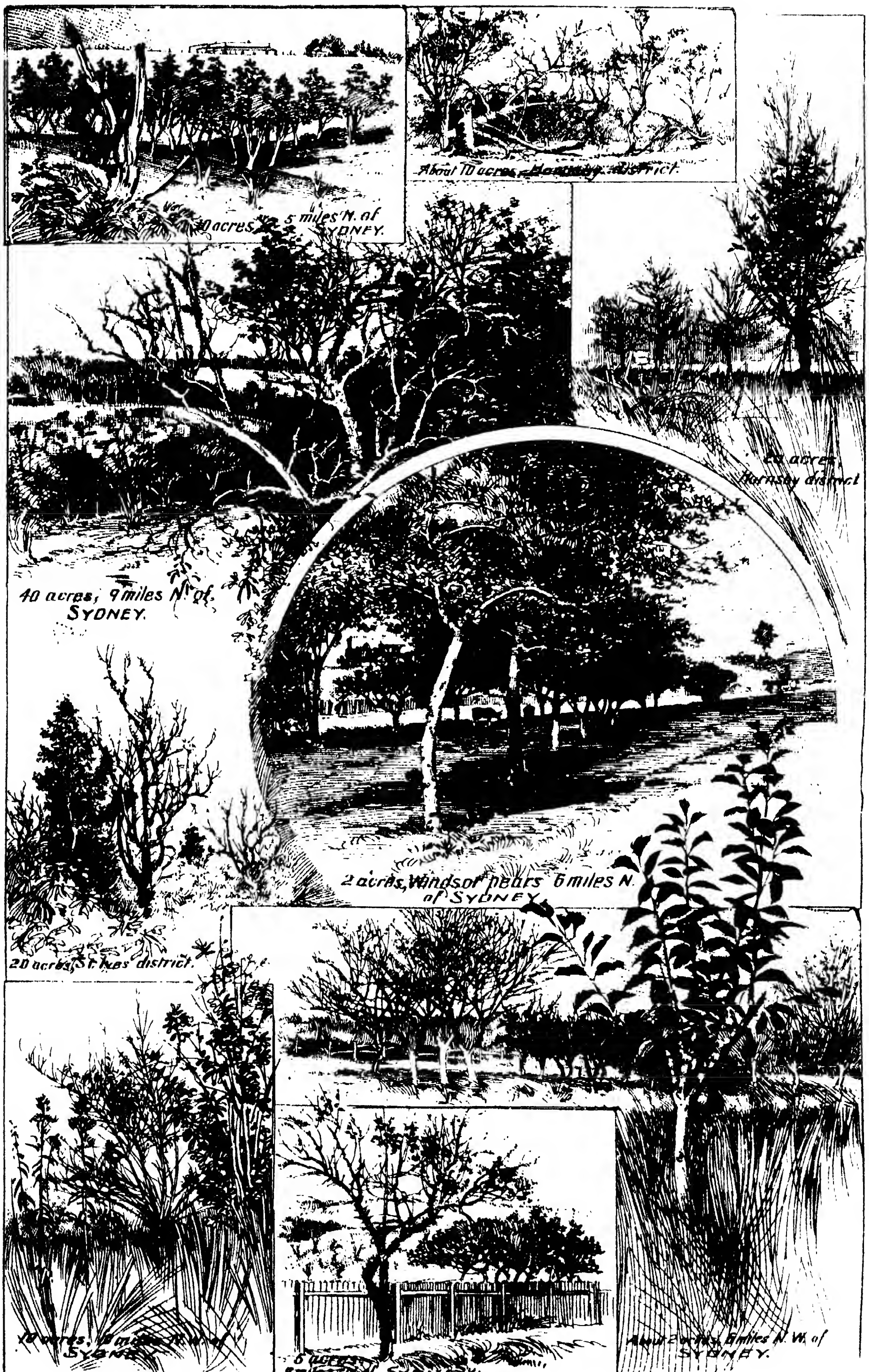
Here are 50 acres of orchard. Almost every tree is dead, or partly so. It would be better to say, "Here are 50 acres of what was *once* an orchard." The trees are dead; that is to say, in one sense they are dead. They have

Fig. 5.—About 10 acres on the North Shore railway line. Half the trees are dead, the remainder are dying. Appears to be on the market for building lots.

few leaves, no fruit. The twigs are bare, and the bark is peeling off and falling to the ground. As orange trees or pear trees they are truly dead, and yet in another sense they are not dead. On the contrary they swarm with life. Every inch teems with beings in the prime of life—insects, moulds, blights, microbes without number. Gnawing, sapping, rotting, according to their wont, and all producing eggs or spores, and shipping them outward on every breeze that blows. With one of these "dead" trees for material a microscopist could occupy a whole day in merely taking down the names of the various forms of life that are busy pulling it to pieces for their own benefit, so that they may grow and send endless generations of their children out to attack and destroy other fruit trees.

The Indictment.

To him who understands the condition of these abandoned orchards, it is hard to speak of them with patience. They swarm with pests, they are burdened with disease. They are a breeding pen of things that corrupt, and a lurking place of things that rob all the neighbouring healthy orchards.



ABANDONED ORCHARDS OF CUMBERLAND COUNTY.

Sketches taken from Photographs, April, 1897.

Insects that gnaw the outside of the trees and tunnel the inside, that puncture and strangle the roots, and that reduce the fruit to a mass of corruption ; insects that lay waste by day, and insects that destroy by night ; that mangle and deform the branches, that reduce the leaves to shreds.

Scales of every sort—fat brown scales that drain the life out of the bark, and small white scales that smother it; flat yellow scales that hang on and suck like leeches, big puffy white poisonous scales that seem to audaciously dare you to come near.

Fig. 6. About 20 acres of orchard, 9 miles north of Sydney. Bearing no fruit ; abandoned and going to ruin.

Moulds that corrode the bark and dry-rot the wood ; moulds that scab and putrify the fruit ; moulds that deform and riddle the leaves ; moulds that girdle and blister and sear.

Mildews that wilt and burn the foliage and reduce it to powder.

Sap-draining mistletoes, draggling and long, that choke the life out of the very bough that keeps them from falling helpless to the ground.

Lichens and mosses that disfigure, and that give lurking place to worse things.

Blights that cause blossom and foliage to droop, wither, and waste away ; blights that devastate with canker and rust.

Microbes that ferment and decompose the tissues of the trees ; that gum, and clog, and rot ; microbes that putrify and send to decay.

Fruit-devouring birds, bats, and quadrupeds.

Innumerable weeds that fill the air with seeds, promises of fruitless human toil in time to come.

Burdened with all these plagues, is it any wonder these abandoned orchards are a source of complaint among fruit-growers?

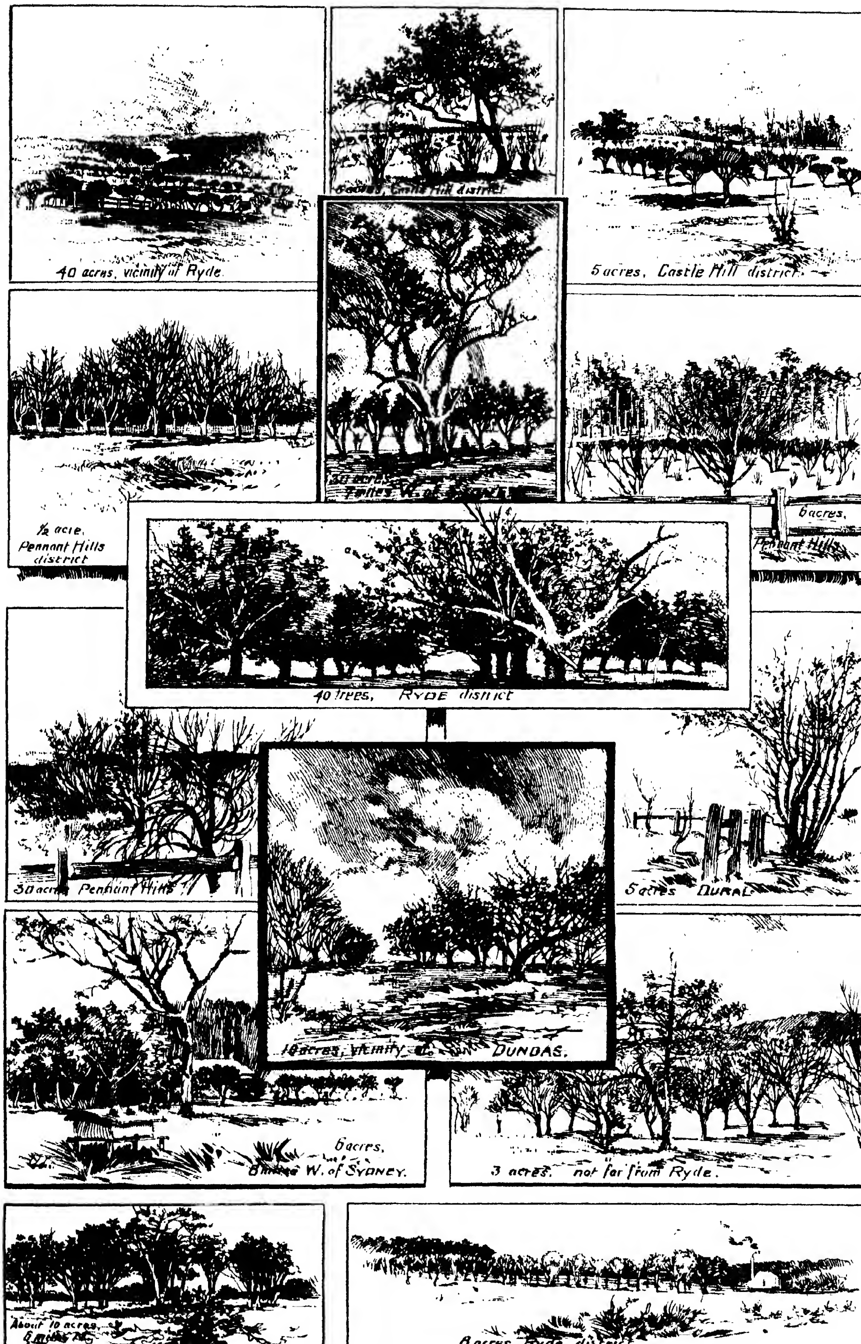
Windsor Pear-trees.

Here is an acre of fine-looking pear-trees. To be sure they bear no fruit, but they need not be condemned on that account, need they? It is true they are of no use to anyone; they are abandoned and not fenced in, but at most seasons they present a rather fine and healthy appearance. The foliage is abundant—too abundant, if anything. In spring they blossom profusely, and are an ornament to the landscape. Surely, they are at least harmless?

Fig. 7.—Nearly 100 acres of abandoned orchard, about 20 miles north-west of Sydney. The trees are either dead or dying, though a few still bear fruit. The place is overrun with weeds.

No, not harmless. These are Windsor pear-trees, and similar patches of old trees of this sort may be found all over the county. These trees are peculiarly subject to a blight that affects the blossoms, foliage, and fruit of pear-trees. So severe is this disease on this particular variety that hundreds of trees may be seen without a single fruit. The blossoms and young fruit are so completely destroyed by the fungus causing the disease that a ripe fruit is rarely to be seen. It is quite safe to say that the trees of this variety harbour a thousandfold more of this particular disease than do those of any other variety.

Is it a serious disease? Yes, it is the most serious disease of the pear that we know in this part of the world. The losses from it reach thousands of pounds annually in this county alone. Hardly a pear-tree escapes. It is uncommon to find in the Sydney market a locally-grown pear that is



ABANDONED ORCHARDS OF CUMBERLAND COUNTY.

Sketches taken from Photographs, April, 1897.

Each Sketch is a fair sample of the whole Orchard.

perfectly free from this disease. You, yourself, have eaten hundreds of such imperfect pears; you may see the blemishes on the next pear you take in your hand.

Shall we let this fruitless variety stand any longer? Why encumbereth it the ground?

It will be worth more as timber than in any other form. The wood, when well seasoned, is in demand by turners for handles, mallets (croquet), and by draughtsmen in thin slabs, for curves, triangles, and T squares. The disease should be cured or these trees should be cut and seasoned for timber.

Fig. 8.—About 10 acres, 9 miles out on the Milson's Point to Hornsby railway. Abandoned, unpruned, dying, bearing no fruit.

The Reason Why.

Why have these orchards been abandoned? There are several reasons. The most obvious to the ordinary observer is the rise in the value of land along the new railway lines penetrating the fruit districts, and the sales by which land formerly cultivated for fruit has passed into the hands of speculators, to be re-sold for building purposes. The speculator knows nothing about fruit-growing, and often cares less. So the trees on the land are neglected and are allowed to stand and rot. But this is only one reason.

In other cases orchards have become too old, or the lands have become too exhausted to be fertile, and they are, therefore, abandoned.

In still others, the varieties have become antiquated, being done out of a market by more modern varieties, and so, being no longer profitable, these orchards, instead of being grafted over, are suffered to go to ruin.

Again, the owner, grown old, or unable to stand competition, cannot keep up the necessary cultivation and supply of manure.

Or, driven to the wall by misfortune, he falls into despair, and lets things drift.

There are scores of reasons why orchards have been abandoned, but these reasons afford no comfort to those who, living next door, suffer in consequence.

What's to be done?

The cost of clearing the land of these nuisances would vary from about 5s. to 15s. per acre. This includes cutting and burning. The cost of freeing Cumberland county of its dead and dying orchards would hardly exceed

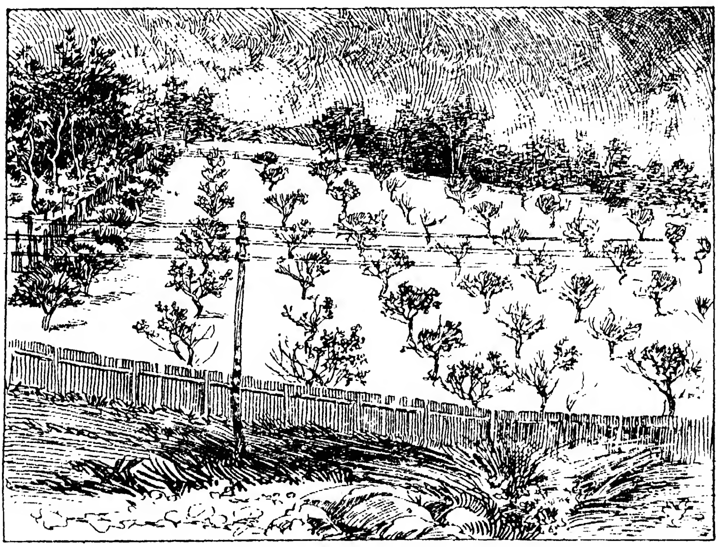


Fig. 9.—About 40 acres, 9 miles north of Sydney. Trees dead and dying.

£5,000. If distributed among the owners the cost to each would be in the vast majority of cases, trifling, though in a few cases it would be considerable.

May I appeal to these owners to do a charitable act,—no, not a charitable act, but simply a just one, and that is, to clear this land of this diseased burden. There is no law compelling such action, but it will be a good action, worthy of a patriotic citizen.

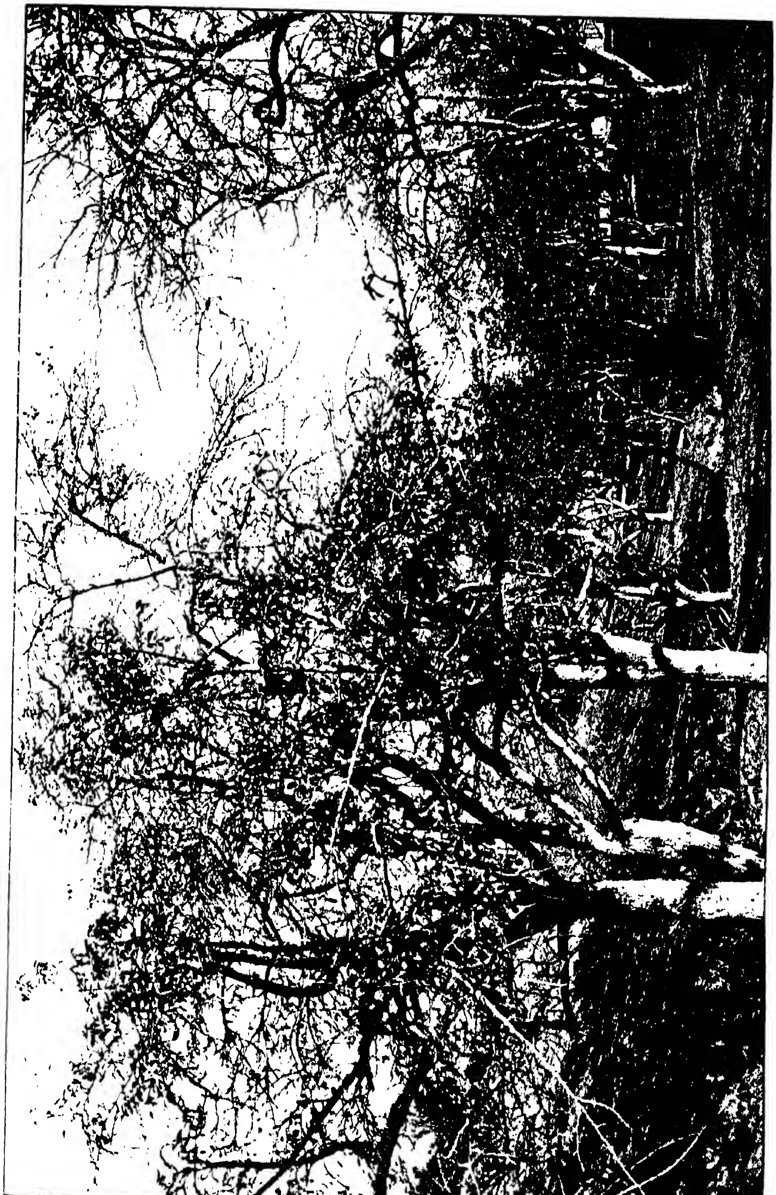


Fig. 10.—Neglected Windsor Pear-trees, of large and vigorous growth, but utterly barren of fruit year after year, and each spring terribly smitten with blight (Pear-scab Fusicladium dendriticum), being thus a potent means of spreading this destructive disease.

Analyses of Commercial Fertilisers obtainable in New South Wales.

F. B. GUTHRIE AND E. H. GURNEY.

The accompanying list of manures obtainable in the Colony, together with their composition as determined by analysis, and their price, is the result of the revision of the list issued in July, 1895. Since that time, although the fertilisers in the market have not altered materially, some new products have been introduced, and some of the old ones have either dropped out, or altered somewhat in composition and price.

It will be noticed that many of the manures are no longer sold by the manufacturers, but are in the hands of agents, undoubtedly a healthy sign. It will also be noticed that the prices for bone-dust have gone up.

The list is compiled in the interest of the farmers, and it is hoped that it may serve as a guide to those requiring any particular class of manure.

In almost every case the figures given are those obtained from samples submitted to the Department for analysis.

The fertilisers sold by the Colonial Sugar Company have, however, not been thus checked in all cases, Mr. Walton's figures being published.

A word is necessary in explanation of the column giving the "values" of the manures. These figures are calculated from the composition of the manures as determined by analysis, a definite unit-value being assigned to each of the fertilising ingredients. The units on which the values here given are computed are as follows:—

Unit-Values of fertilising ingredients in different manures for 1897:—

	s.	d.	
Nitrogen in ammonium salts and nitrates... ...	9	6	per unit.
Nitrogen in blood, bones, offal, &c.—fine	10	0	"
Phosphoric acid in " " "	2	0	"
Phosphoric acid in superphosphate—			
" water soluble	5	4	"
" citrate-soluble	4	6	"
" insoluble	2	0	"
Potash	5	4	"

To determine the value of any manure the percentage of each ingredient is multiplied by the unit value assigned above to that ingredient, the result being the value per ton of that substance in the manure. For example, a bone-dust contains 4 per cent. nitrogen and 20 per cent. phosphoric acid:—

4 × 10s. =	£2	0	0	=	value of the nitrogen per ton.
20 × 2s. =	2	0	0	=	value of the phosphoric acid per ton.
	£4	0	0	=	value of manure per ton.

It must be clearly understood that the value thus assigned, depending solely upon the chemical composition of the manure, does not represent in all cases the actual money value of the manure, which depends upon a variety of causes other than the composition, and is affected by local conditions.

It is simply intended as a standard by which different products may be compared. At the same time it has been attempted to make the standard indicate as nearly as possible the fair retail price of the manure, and the fact that in the majority of cases the price asked and the value assigned are fairly close shows that the valuation is a reasonable one.

To economise space, only those ingredients are given whose presence directly affects the value of the manures. Full analyses can be obtained if desired.

In the table of mixed fertilisers, &c., it will be noticed that three columns are assigned to phosphoric acid, and a different unit-value assigned to each, water soluble, citrate-soluble, and insoluble. When bones or mineral phosphates are acted on by sulphuric acid, a portion of the tri-calcic phosphate is converted into another lime-compound known as mono-calcic phosphate or superphosphate. This compound is soluble in water, and it is to its presence that the rapid action of the superphosphate is due.

This is the "water-soluble" acid of the table.

In many superphosphates, however, a considerable portion of this compound has undergone change. This change may be due to the quantity of sulphuric acid used in the manufacture, to the quantity of salts of iron and alumina present, or to the length of time it has been kept, and it results in the formation of a third lime-compound—bi-calcic phosphate. This is known as "reverted" or "retrograde" phosphoric acid, and, being insoluble in water, but soluble in ammonium citrate, is here given under the heading "citrate-soluble." A value has been assigned to the phosphoric acid in this condition intermediate between the others. Its manurial activity has been found to be very little less than that of the water-soluble acid.

As many manure manufacturers prefer to use the term "reverted," it is well to keep in mind that in this list the term is identical with "citrate-soluble." The only exception is in the case of Thomas phosphate. In this product the "citrate-soluble" is a compound of lime distinct from the others; it is neither bone-phosphate nor superphosphate, nor reverted phosphate, but is a fourth lime compound, known as tetra-calcic phosphate. It is soluble in ammonium citrate, and has practically the same manurial activity as reverted phosphate.

In the fourth table are a number of waste products which may in many cases be economically utilised.

I.—Bone and Blood Manures.

Manure.		Where obtainable.	Moisture.	Insoluble Matter.	Nitrogen.	Equivalent to Ammonia.	Phosphoric Acid.	Equivalent to Tri-calcic Phosphate.	Value.	Price asked.
									£ s. d.	£ s. d.
Bone-dust		Sydney Soap and Candle Co., 337, Kent street.	4·93	2·73	4·93	5·98	20·24	44·19	4 10 0	3 10 0
Refuse—Ashmagandy ..		Sydney Soap and Candle Co., 337, Kent-street.	6·06	1·99	7·05	8·61	15·40	33·63	5 1 0	......
Bone-meal		H. Macnamara, Hay-st., Darling Harbour	5·79	3·09	4·87	5·91	16·00	34·90	4 1 0	3 10 0*
Furnace residue		Municipality of Orange	4·11	42·18	·49	·59	4·64	10·10	0 14 0	2 0 0†
Bone-dust ..	No. 1	Geo. Shirley and Co. (formerly Shirley, Clayton and Co.), Pitt-street.	....	....	2·88	3·50	22·44	49·00	3 13 6	4 0 0
	No. 2	,, ,, ..	....	....	2·67	3·25	23·82	52·00	3 14 0	4 0 0
	No. 3	,, ,, ..	....	....	4·11	5·00	19·69	43·00	4 0 0	4 0 0
	No. 4	,, ,, ..	8·90	3·89	3·26	3·94	22·79	49·75	3 18 0	4 0 0‡
	No. 6	,, ,, ..	....	....	3·08	3·75	22·44	49·00	3 15 6	4 0 0
Bone-dust ..	No. 1	Australian Manures Co., 39A, Market-st.	....	....	3·31	4·03	22·96	50·12	3 19 0	4 0 0
	No. 2	,, ,, ..	....	....	5·97	7·26	10·50	23·00	4 1 0	3 15 0
D.D. Fertiliser..		,, ,, ..	....	....	6·17	7·50	3·89	8·50	3 9 6	3 10 0
Blood manure		,, ,, ..	....	....	12·37	15·03	....	....	6 3 6	6 0 0
Concentrated blood		,, ,, ..	....	....	12·35	15·00	·82	1·79	6 7 0	4 15 0
Gee's Fertiliser, B.B... ..		Sydney Meat-preserving Co., Rookwood and Auburn.	10·16	·79	5·30	6·44	12·66	27·60	3 18 0	4 0 0
,, ,, P.B.B. ..		Sydney Meat-preserving Co., Rookwood and Auburn.	9·50	·71	4·77	5·79	11·39	24·80	3 10 6	......§
Bone-dust		G. W. Eaton, Madeline-street, Enfield..	7·12	·51	4·21	5·11	18·94	41·35	4 0 0	3 15 0‖
"Nipho"		Sydney By-product Manufacturing Co., Alexandria. Agents:—Geo. Shirley and Co.	7·48	·20	12·58	15·28	....	....	6 6 0	4 15 0
Bone-dust		G. Hunziker, Moorland	·62	9·35	2·66	3·23	24·7	53·93	3 16 0	......
,, ...		A. Wooster, Carlingford	4·97	3·12	3·84	4·66	22·44	49·00	4 3 0	3 10 0¶
,, ...		D. Davies, Bulli	6·55	1·02	4·06	4·93	24·92	54·41	4 19 0	4 5 0

* Six ton lots for £3 per ton. † On trucks at Orange. ‡ Raw bones. § Same price and composition as B.B.; with potash added, 5s. per ton extra for each per cent. potash. Less 5 % for cash. ‖ On trucks. ¶ Special prices for large quantities.

II.—Other Simple Fertilisers.

Manure.	Where obtainable.	Nitrogen.	Equivalent to Ammonia.	Lime.	Potash.	Value.	Price asked.
						£ s. d.	£ s. d.
Sulphate of Ammonia	Australian Gaslight Co.	20·70	25·13	....	....	9 16 6	9 0 0
Soot	Practical Chimney-sweeper's Association, Grove-street, Petersham.	2·42	2·94	....	....	1 4 0	...... *
Kainit	Australian Manures Co., 39A., Market-street	....	....	....	12·95	3 9 0	4 10 0 †
Sulphate of Potash	"	....	....	....	52·37	13 19 0	14 0 0
Nitrate of Soda	" "	18·00	21·14	....	....	8 11 0	15 0 0
Sulphate of Ammonia	" "	20·70	25·13	....	....	9 16 6	9 0 0
Sulphate of Iron	" "	....	....	....	....	......	...... ‡
Kainit	Geo. Shirley & Co., Pitt-street	....	....	....	12·95	3 9 0	4 10 0 §
Sulphate of Potash	" "	....	....	....	52·37	13 19 0	14 0 0
Sulphate of Ammonia	" "	20·30	24·60	....	....	9 0 6	9 0 0
Lime	Cullen Bullen Lime Co., Sussex-street	....	....	93·00	....	......	1 13 0 ‖
Agricultural Lime	" "	....	....	70·00	....	......	0 16 0 ¶

* Twenty bags at 2s. each, on trucks, Petersham. Smaller quantity, 2s. 6d. per bag. † Kainit also contains 30 per cent. of magnesium salts. ‡ 8s. per cwt. § Kainit also contains 30 per cent. of magnesium salts. ‖ 22s. 6d. per ton on rail at Portland. ¶ 8s. per ton on rail at Portland.

III.—Superphosphates, Mixed Fertilisers, and Imported Fertilisers.

Manure.	Where obtainable.	Water.	Nitrogen.	Equivalent to Ammonia.	Insoluble matter.	Water Soluble Phosphoric Acid.	Citrate Soluble Phosphoric Acid.	Insoluble Phosphoric Acid.	Potash.	Value.	Price asked.
										£ s. d.	£ s. d.
Odam's Superphosphate	Holdsworth and Macpherson, 254, George-street.	12·82	......	......	3·58	15·80	1 10	1·29	......	4 11 6	6 10 0
Odam's Complete Manure	" " ..	10·01	3·50	4·25	7·54	10·42	·86	1·29	5·48	6 4 0	10 0 0
Ohlendorff's Dissolved Peruvian Guano.	Gibbs, Bright, & Co..	8·50	5·74	6·97	7·43	11·78	......	......	2·06	6 11 0	14 0 0
Albert's Thomas Phosphate.	Australian Manures Co., 39A, Market-street.	......	.....	......	......	......	11·40	5·35	......	3 3 0	4 15 0

Manure.		Where obtainable.	Nitrogen.	Equivalent to Ammonia.	Water Soluble Bone Phosphate.	Citrate Soluble Bone Phosphate.	Insoluble Bone Phosphate.	Equivalent to total Bone Phosphate.	Potash.	Value.	Price asked.
										£ s. d.	£ s. d.
Superphosphates or Soluble Series.	No. 1	Colonial Sugar Refining Co. Agents—Geo. Shirley & Co., Pitt-street.	....	....	37·	....	....	37·	....	4 11 0	4 5 0
	2	" " ..	1·6	2·	33·	....	....	33·	1·	5 1 0	5 2 6
	3	" " ..	3·3	4·	28·	....	....	28·	2·	5 11 0	6 2 6
	4	" " ..	4·9	6·	24·	....	....	24·	4·	6 6 6	7 2 6
	5	" " ..	3·3	4·	26·	....	....	26·	7·	6 12 6	7 2 6
	6	" " ..	·8	1·	30·	....	....	30·	7·	6 0 0	6 2 6
Cheap Superphosphate Series.	No. 10	" " ..	....	....	15·	8·	24·	47·	....	3 14 0	3 12 6
	11	" " ..	1·6	2·	12·	7·	23·	42·	1·	4 5 6	4 7 6
	12	" " ..	3·3	4·	12·	5·	15·	32·	2·	4 15 0	5 2 6
	13	" " ..	1·6	2·	12·	6·	19·	37·	5·	5 1 0	5 7 6
	14	" " ..	2·5	3·	12·	5·	14·	31·	6·	5 7 6	5 17 6
Bone Phosphate Series "Reverted."	A	" " ..	....	....	....	18·	42·	60·	....	3 15 6	3 0 0
	B	" " ..	·8	1·	....	17·	38·	55·	1·	4 3 0	3 10 0
	C	" " ..	·8	1·	....	16·	36·	52·	3·	4 9 6	4 0 0
	D	" " ..	1·6	2·	....	14·	33·	47·	4·	4 16 0	4 10 0
	E	" " ..	2·5	3·	....	10·	31·	41·	6·	5 4 0	5 10 0

IV.—Waste-products, Ashes, &c.

Manure.	Where obtainable.	Water.	Volatile and Combustible.	Nitrogen.	Ammonia.	Insoluble.	Lime.	Phosphoric Acid.	Potash.	Value.
										£ s. d.
Deposit from wool-scouring tanks. 1	Liverpool Wool-scouring Works.	....	....	·64	·78	....	....	....	·72	0 10 3
" 2	,, ,,	....	....	1·02	1·24	....	....	·16	·39	0 12 0
" 3	,, ,,	....	....	1·37	1·66	....	....	·14	·20	0 14 0
Sheep-manure	,, ,,	9·71	50·91	1·79	2·17	32·26	2·0	·91	·92	1 3 9
"Scutch" from limed pelts	Hugh Wright, Auburn	5·32	73·42	1·80	2·18	3·61	9·36	·89	·20	0 19 0
Decomposed hair and lime	Fellmongery	9·70	57·08	6·86	8·33	1·22	26·27	....	....	3 3 6
Bat-deposit	Cave Flat, Cooradigbee	5·43	12·98	·50	·61	57·64	5·60	12·12	....	0 19 7
Tan-yard refuse	Tanneries, St. Mary's	6·43	33·83	2·24	2·72	21·43	26·96	·67	....	1 1 6
Filter-press muck	Cane-mills, Broadwater	16·39	26·07	·22	·27	34·86	13·20	*5·98	·44	1 12 0
Megass	Clarence River cane	22·86	67·32	·63	·78	8·61	·30	·01	·05	0 6 0
Megass-ash	,, ,,	....	....	....	....	87·69	3·07	·16	·51	0 3 3
,,	Richmond ,,	....	....	....	....	....	1·11	·28	4·79	1 9 0
Bloodwood-ash	....	....	....	....	....	....	8·47	·27	5·25	1 11 9
Ironbark	....	....	....	....	....	....	....	·82	1·53	0 10 0
Blackbutt-ash	....	....	....	....	....	....	7·27	·04	2·02	0 12 0
Red-gum-ash	....	....	....	....	....	....	....	·38	4·17	1 5 6
Spotted-gum-ash	....	....	....	....	....	....	....	·10	·70	0 4 3
Boxwood-ash	....	....	....	....	....	....	....	·67	1·65	0 10 6
Seaweed-ash	....	....	....	....	....	....	9·27	·49	·59	0 4 0
Ash of Kerosene shale	Hartley Vale	1·49	27·93	·70	·85	67·59	....	·28	·14	0 7 0
Cave-deposit, shells, &c.	Cowan, Hawkesbury River.	2·11	....	·52	·99	....	35·40	1·59	·88	0 13 6
Cave-deposit	Macleay River	23·06	16·01	2·43	2·95	26·77	13·88	7·40	....	1 11 9
Gypsum	Marulan	(Crystallised $CaSO_4$ = 92·64.)				4·47	....	....	....	....
Flue-deposit	Maitland	....	....	....	....	83·75	2·56	·32	·31	0 2 0
,,	Liverpool	....	....	....	....	91·17	·42	1·29	·17	0 2 6
,, from sanitary furnace	....	....	....	....	....	63·53	6·64	1·82	1·61	0 10 0
Night-soil preparation, "Pinhoe" manure.	....	·92	9·54	·21	·25	57·53	14·71	1·26	·56	0 9 6
Night-soil preparation, No. 1	F. Artlett, Parramatta	7·33	30·06	2·10	2·55	46·38	3·74	1·92	·61	1 5 0
,, ,,	,, ,,	10·11	42·59	4·97	6·03	·94	$CaCO_3$. 30·12	·39	....	2 10 0
,,	Mr. Halstead, O'Brien's patent.	1·54	12·36	·54	·65	77·95	....	·63	....	0 6 0
Fowl-manure	....	3·95	16·48	1·47	1·78	70·16	2·10	1·94	....	0 19 0
,,	....	1·54	15·23	·86	1·04	79·96	·64	·59	·33	0 11 0
Bat-guano	....	14·11	17·69	1·55	·88	28·77	13·72	†11·42	....	2 0 0

*5 per cent. soluble in water. †1 per cent. of the phosphoric acid is water-soluble.

Dairying in New South Wales.

Notes and Notions.

M. A. O'CALLAGHAN.

To begin with the cow, I must say that while I have seen some very useful dairy cows in the Colony, particularly on the south coast, a great, in fact the greater, portion of the dairy cows I have seen throughout the Colony do not appear sufficiently good to be worthy of their place in a dairy herd. This is no doubt owing to the fact that dairying is yet new to a great portion of the Colony, and there has not been time to build up good class herds. A number of cows I have seen are very light and weedy, no doubt due to in and in breeding; and I think the greatest credit is due to those who have gone to the trouble and expense of importing new blood into Australia. There is yet a great deal more wanted, but as the cost of bringing cattle from Europe is extremely high, about £70 per head, it is to be feared progress in this direction will be slow unless the combined action of the Governments of Australia will be the means of having the freight reduced. If not, the Government could perhaps meet the matter in some other way, either by the importation of cattle on their own behalf, or by defraying portion of the freight for importers, provided the animals were approved of. From my own observations and from the figures I have seen quoted by others I fear the milk yield of the cows of the Colony forms a very low average, and I am confident that there is more money to be made or lost in this than in any other department of Australian dairying. The milk yield of the cows of the Colony is estimated at about 280 gallons per head. In a few years, by means of careful breeding and selection, which can only be done where a record of each cow's milk is kept, this could be raised to 450 or 500 gallons per head. In most countries a cow is not reckoned to be worth her food unless she yields 600 gallons of milk per annum; and if New South Wales is to keep pace with the rest of the dairying world, her farmers will have to aim at and endeavour to produce a milch cow of a higher standard. If farmers can be induced to measure or weigh each cow's milk twice a week (once in the morning, and once in the evening), and calculate therefrom her annual yield, we will be on the high road to improvement, and, I think, the Government might reasonably do something towards stimulating this practice among our farmers.

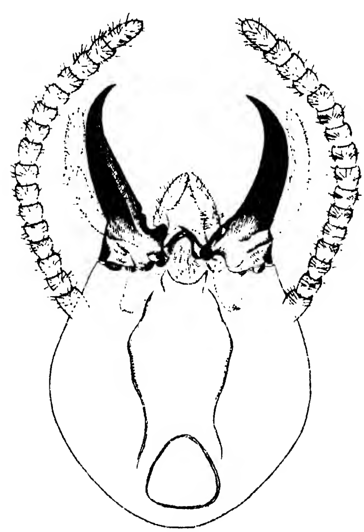
Now, having got good cows, they will require to be fed, not allowed to starve, as many cattle are doing just now, owing to the failure on the part of their owners to provide anything for the rainy, or rather, for the dry day. Farmers will say it will not pay to grow other food than grass for cattle. Perhaps it will not pay to raise crops for bad or indifferent cows, but it will certainly pay to keep good ones from half-starving whenever a dry season ensues. There is no absolute necessity for dairy farmers to go in extensively

for tillage year after year, for during many years very little will be needed besides the ordinary pasture, but I do say that no farmer should be found in the autumn without sufficient food to put his cattle over a trying winter. If all goes smoothly, and a favourable grass season is had, little if any of the food will perhaps be used, but it will remain over for another year; and if only some be used there need be grown the following season only sufficient to replace what has been eaten. Ensilage, lucerne hay, and numerous other foods will hold good for some years. Sorghum is a very useful plant, is easily grown, and yields a heavy crop, besides the fact that it contains a very large amount of digestible matter suitable for dairy cows. Maize ensilage can also be highly recommended for dairy cows; and, where plentiful, crushed oaten grain, mixed with a little bran, should be used, as it makes a most excellent food.

Coming to milk, how long is it before all farmers can be got to strain and aerate the milk? This is absolutely necessary for the production of good butter, if milk is not supplied to the creamery twice a day, and immediately after milking. In some countries this is compulsory by law, and especially in countries where much cheese is made, as cleanliness in cheese-making is even more important than in butter-making.

I shall now suppose that the milk is taken to a creamery, or separated by machinery on the home farm, and as early as possible I will deal with this portion of dairying.

(1) HEAD OF WORKER.



(2) HEAD OF SOLDIER.

(3) WING OF PERFECT INSECT.

WHITE ANTS (Termes lactis, n. sp.)

Details of Head of Worker and Soldier, and Wing of Perfect Insect (much enlarged).

White Ants,

With some Account of their Habits and Depredations.

By WALTER W. FROGGATT,
Government Entomologist.

Specimens of potatoes were received from Mr. Broughton Corrie, Colo Vale, about the middle of February, with the information that when harvesting his crop he had found those in one corner of the field covered with white ants, which were burrowing into and gnawing the centres out of otherwise perfectly sound tubers; but as none of the insects were sent with this consignment, further information was asked for.

In response to my request, further samples of potatoes were sent down swarming with live soldiers and workers of these destructive little creatures, and so honeycombed with their attacks that only the outer surfaces were solid. Shortly afterwards I paid a visit to Mr. Corrie's farm, and made the following observations:—

The bulk of the potatoes had been harvested, but a few remained undisturbed in the corner infested, and every one we turned over was more or less riddled with ant holes. The field in which the crop had been planted was new land, only cleared the previous season, and still containing a number of the larger stumps, while about 30 yards from the corner of the paddock there was a large white ants' nest (termitarium), which, partly covering a large stump, reached to about 5 feet in height, and when cut down was found to be swarming with termites in all stages of development. There is not the least doubt that it was foraging parties from this nest that had invaded the paddock.

This termite upon examination proved to be our commonest Sydney species, which is responsible for nearly all the damage done to houses in the city and suburbs. It belongs to the typical genus *Termes*, and in a concluding paper in my *Monograph of the Australian Termitidæ*, being published in the Proceedings of the Linnean Society of N.S.W., I propose to call it the "Milk Termite" (*Termes lactis, n. sp.*), on account of the soldiers ejecting a globule of milk-like fluid when disturbed. It was this species that destroyed the roof of the Australian Museum last year, and two years before eat out the floor of the records office in the buildings of the Department of Education in Bridge-street. The same termites are to be found destroying the woodwork of the hot-houses in the Botanic Gardens, and in nearly every instance where the white ants have been sent in from buildings about Sydney they have proved to belong to this species.

In the immediate vicinity of Sydney these termites do not build mound nests, but are found under logs or stones, gnawing the bark off dead trees,

or in small communities about the trunks of trees; but upon the Blue Mountains and all over the Shoalhaven district they build large, regular mound nests.

These termitariums measure from 2 to sometimes 6½ feet in height, broadest at the base, and tapering slightly to a rounded summit. The outer surface consists of a solid earthern wall, often from a foot to 18 inches in thickness, formed of particles of earth gathered upon the surrounding surface, and cemented together with the excreta of the workers voided while placing the earth in position. This wall encloses a compact woody mass, slightly separated from it on the sides, but almost touching at the apex. This central portion varies in different parts of the nest in its structure, but chiefly consists of titurated wood that has been eaten and passed through the bodies of the termites, and has a regular foliated structure, these lumps forming a coarse irregular honeycomb. The cap is composed of rounded irregular lumps, but towards the centre, about 6 inches from the ground-level, there is a soft papery-like mass about the size of a man's head, composed of fine sheets folding round each other, and full of holes and irregular galleries; this is the nursery where all the very small larvæ live after they have hatched out. The eggs, which look like grains of sugar, will be found piled up on the edge of a terraced formation where it joins the nursery. Here the queen's cell is situated, somewhat about the shape and size of an inverted saucer, and surrounded by other terraced cells. Where the base of the nest comes in contact with the ground it forms a coarse network of cells with galleries leading downward into the earth, from which they gain access to the outside world.

All these mounds are in the first instance formed over a dead stump or fallen log, which in the course of time is by the action of the termites transformed into this titurated woody material. The social life and transformations of the different forms found in these nests is very remarkable, and has puzzled naturalists from earliest ages. Pliny, in his "Natural History of the World," where all the curious and remarkable "facts" known to the ancients are recorded, gives the following account of the "Indian Pismires," which is probably intended for white ants:—

"In the country of the Northern Indians, named Dardae, the ants do cast up gold above the ground from out of holes and mines within the earth; these are in colour like to cats, and as big as the wolves of Egypt. This gold beforesaid, which they work up in the winter time, the Indians do steal from them in the extream heat of summer, waiting their opportunity when the pismires lie close within their caves under the ground from the parching sun, yet not without great danger. For if they happen to wind them, and catch their scent, out they go, and follow after them in great haste, and with such fury they fly upon them, that oftentimes they tear them in pieces, let them make way as fast as they can upon their most swift camels, yet they are not able to save them, so fleet of pace, so fierce of courage are they, to recover the gold they love so well."

Each nest contains three very distinct classes or castes. First, the winged males and females, which hardly differ in general appearance from each other, and are popularly known as "flying ants." They are developed from the eggs by a gradual series of moults, and when about half grown show well-formed wing cases. The nests during the winter months are full of these termites in all stages of growth, and early in November they undergo their final moult and emerge with two pairs of full grown wings. The workers now cut regular galleries through the earthen walls, which are guarded by the soldiers until the time comes for them to all fly from the nest. The

bulk of them are destroyed by birds and hundreds of other insects that prey upon these helpless creatures, while thousands of them perish around lamps and fires. A few pairs, however, manage, after shaking off their wings (which have a curious cross suture close to the shoulders by which they are very easily pulled off), crawl under a log, where, if they manage to exist until they are found by a foraging party of workers and soldiers, they found a fresh colony.

What becomes of the male termite after the female becomes pregnant I do not know, as I have never been able to find him in a well-developed nest, but the female, which is popularly known as the "queen white ant," as soon as she is settled in her cell, often called the "royal chamber," begins to lay eggs, and while the head and thorax remain at the normal size, her abdomen swells out into a cylindrical rounded white mass as thick as a small pea-pod, which renders her quite helpless, and incapable of crawling about. The body now consists of a great number of egg-tubes, or ovaries, leading into the egg-laying duct, and from this single insect flows the whole life and reproductive power of the colony. The queen is carefully fed and looked after by the workers, who remove the eggs into adjoining galleries between her cell and the true nursery previously described. The queen may lay eggs for some years, but I do not think either at the rapid rate or for so long as many of our popular writers have asserted, for the workers have the power (probably in the method of feeding the young larvæ) of producing supplementary queens, which never pass through the winged form, but are produced direct from the egg, and probably supersede the queen in cases of emergency, when she has outlived her usefulness or been accidentally destroyed.

The workers, which constitute the bulk of the members of every nest, are aborted females and males (and not only females as among the bees), whose duties are to do all the building and repairing of the nests, look after the queen, eggs, and larvæ, and all other work in the community; and it is to the powerful jaws of this form that we are indebted to their destructive habits. They measure about 2 lines in length, of a uniform dull white colour, with large rounded heads sometimes tinted with pale yellow; the antennæ formed of a number of rounded bead-shaped segments, and a rounded upper lip, which covers the short powerful jaws; the thorax is comparatively small; the legs short and stout, armed with fine spines at the base of the shanks, and the abdomen large and rounded.

The soldiers are also aborted males and females, and are never as numerous as the workers. Their duties are to protect the nest, and drive off any enemies that appear when it is damaged or broken into, and direct the labours of the workers when adding to or mending gaps in the outer surface of the nest.

They are more slender in form than the workers, with the head pear-shaped, and the jaws produced into two stout scissor-like jaws, while above them in the centre of the head is a small cylindrical opening connected with a chamber at the base of the head, through which they can eject the white fluid previously mentioned, which is also a weapon of defence against their enemies.

In these remarkable households it is the blind leading the blind, for neither the soldiers or workers are furnished with eyes, and all their movements must be directed by their delicate sense of touch, for when mending a gap in the nest the soldiers always form themselves into a regular row, standing just far enough apart for them to touch the tip of each others antennæ, which are constantly moving, while each worker comes between the soldiers and deposits its load, returning until the breach is closed.

Besides the above-described forms, there are always a great number of immature termites all over the nest, from the tiny larvæ just hatched from the eggs to the pupæ with their wing cases reaching down to the middle of the back.

There are several other species of this family belonging to the genus *Eutermes* that are very common about Sydney, which seem to confine their attacks to fences, bridges, and outbuildings, seldom, if ever, coming into the timbers of our houses. They form small dome-shaped nests over small stumps, perfectly rounded on the apex, seldom more than 2 feet in height with the outer crust not formed of earth, but of a very tough strong woody substance, while the internal structure is not so regular as those of the large mound nests.

These *Eutermes* also build nests upon the branches of both living and dead trees, sometimes running a covered gallery leading out of the ground up the trunk of the tree to a rounded nest 40 or 50 feet above the ground, which sometimes is constructed of a rounded form with a dead branch intersecting it in the centre, or at other times simply resting upon a forked branch. The soldiers of this group differ from all others in having the front of the head produced into a rounded pike-like nose, which has led to them being called "nasuti"; they also can eject a fluid, like honey in consistency, through the tip of this snout, which is their only protection.

This attack upon potatoes is a new departure on the parts of the white ants, which though omnivorous in their habits, usually feed upon dry materials, and I can find no record of them infesting growing tubers before.

They are sometimes found in orchards and gardens, both in Victoria and New South Wales, destroying the central portion of the stems of vines and fruit-trees, in most cases when the fruit-trees have been injured (except when very old and decayed in the centre) the termites commence operations upon the dead wood caused by the scar of the graft, which should not be buried beneath the surface of the soil, and could be protected by a bit of pitch or tar when the tree is planted.

In "Insect Life"* some interesting notes are given to a correspondent writing from the Goulburn Valley, Victoria, who wrote that his vines and fruit-trees were damaged by white ants. The Editor of "Insect Life" says:—"In the orange groves of Florida considerable damage has been sometimes done by our common white ant (*Termes flavipes*). We find that it invariably attacks wood buried or lying upon the ground, and that its central nests are rarely discovered, but generally exist in deeply buried roots or under very large stumps and logs. The workers extend their subterranean galleries for immense distances and it is therefore practically impossible to trace them to a source and thus break up the colony. They damage living trees by eating away the bark about the collar and root, and growing wood is only attacked by them under exceptional circumstances, when there is no dead wood, or when they wish to escape from the heated soil." He suggests cutting away all dead bark, opening out the soil about the surface roots and spraying with kerosene emulsion or boiling water.

Crichton† gives an account of a species (*Termes futile*) which is very destructive to trees in Arabia; the natives protect them from the termites by plastering them over with sheep dung which drives the white ants away.

In Ceylon they attack the coffee and tea plants, gnawing the stems just beneath the ground.

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* Insect Life, vol. I, p. 340–1, U. S. Department of Agriculture, America.

† History of Arabia Ancient and Modern, A. Crichton, Edinburgh, 1833.

In the southern States of America, in the Mississippi districts, they devour the stalks of the cotton plants, eating out the central portion of the stalk. At a recent meeting of the Linnean Society of New South Wales, Mr. Thos. Steel, of the Colonial Sugar Company, exhibited a beautiful little termite nest constructed in a stem of sugar-cane where all the pith had been gnawed out between the two knots and replaced with a network of titurated woody matter; this curious specimen came from a sugar plantation in Fiji.

In the Gulf country of Northern Queensland I have seen them construct galleries up the trunk of nearly every tree we cut (when blazing a track across the table-lands of the Flinders River), to reach the dead wood caused by the scar.

French.* in his handboook, gives a general account of "The Victorian White Ant," *Termes australis?* (which, however, is the same species as I have just described) attacking vines and fruit-trees in that colony, and gives the usual preventive remedies.

Many remedies have been tried for the destruction of white ants, and when the insects are get-at-able some are effective ; but as they nearly always work under cover their presence is seldom detected until they have done all the harm they can and the timber begins to crack and fall.

Therefore, when building, the best methods to adopt to deal with them is to treat all the timber used with some preservative fluid or chemical, or to construct the house upon strong piles clear of the surrounding ground, and each covered with a larger zinc plate round the protecting edges of which they cannot crawl. Both these methods have been used with considerable success in North Queensland and other tropical countries for many years; but in the course of time, either through a hole rusting through the plate, or more often by some careless person resting loose timber against the walls the ends of which are resting on the ground, they eventually gain access to the house. Most preservatives lose their virtue with age, often assisted by the weather and dry-rot, which is soon found out by the ever-watchful termites. As a case in point, I once found a colony in a block of solid wood that had been built into a thick sun-dried brick wall, about 4 feet from the floor, and though it was not more than a foot square with no other wood near it, yet they had, in some mysterious manner discovered its whereabouts, and worked their way up from the floor.

In India, creosote (oil of tar) was at one time used by the Government for treating all their railway sleepers before they were laid down, but arsenious soda, which is a preparation of arsenic and soda dissolved in mineral oil, and which are the chief ingredients of the patent "anti-ant" liquid sold in Sydney, has been found, if thoroughly applied, to be a great preventive. Arsenic plays an important part in the destruction of these pests, for where the entrance to their tunnels is discovered pouring arsenic and sugar mixed into a syrup down into their workings will destroy great numbers, for they readily eat this mixture which kills them, their bodies being eaten by the next party cause them also to succumb, these again are devoured by the survivors, and where it is only a small nest or an advanced guard from some other band they often all fall victims to their cannibalistic habits. Kerosene or carbolic oil poured into their nests will also stop them but only temporarily, for the survivors will withdraw and seeking fresh quarters commence operations again.

In a report issued on the white ant ravages in St. Helena, where they were originally introduced in the timbers of a condemned slaver some twenty

* Handbook of Injurious Insects of Victoria, in part ii, p. 137, 1893.

years before, and where they have since then destroyed over £30,000 worth of property in Jamestown alone, it was said that teak and Myrtaceae in general resisted their attacks better than any other woods. Timbers saturated in mineral salts were readily attacked, while most of the timbers dressed with mineral oils were only protected upon the surface.

The chief precautions to take when building is to see that all stumps and dead wood in the vicinity are dug up or burnt out of the ground, and all nests within a wide radius set on fire, which is easily done, as the whole of the interior burns very readily if two holes are made in the walls one near the ground to light it and another at the summit to cause a draught. I have frequently noticed termite nests, particularly those of the smaller *Eutermes* upon the road side, and nearly always the adjoining fences bore marks of their attacks; yet a farmer will go and put a new rail or post on his fence, but never think of destroying the nest where his enemies are waiting for the new food supply.

Entomological Literature.

We have received Miss Ormerod's twentieth report upon Injurious Insects, which keeps up to date her many valuable and interesting observations upon the destructive insects of Great Britain.

It is prefaced with a portrait and short obituary of her sister, the late Miss Georgiana E. Ormerod, who for many years has assisted her in her natural history studies, and enriched them with careful drawings. From this contribution to economic entomology we make the following brief notes; in the chapter upon "Leafage Caterpillars," she describes the damage done to the oak forests in different parts of England during the last year by the oak-leaf roller moth (*Tortrix viridana*), and two other well-known species.

The notes upon the Mediterranean mill moth (*Ephestia Küehniella*) are important to Australian entomologists from the immense amount of damage their prolific offspring can cause in flour mills, and the fact that they have been recorded in this Colony.

Gardeners growing water-cress will find how destructive the larvæ of such insignificant creatures as caddis flies (*Trichoptera*) can become when the balance of power in the animal world is altered. The water in which the cress was cultivated was frequented by trout, which eat the larvæ; but a flock of herons appeared and eat all the fish, whereupon the caddis fly larvæ increased in such numbers that they eat off over three-quarters of the water-cress.

The chapter upon eel-worms, or onion sickness, gives a lucid account of the disease caused by these minute nematodes (*Tylenchus devastrix*) which attack the neck of the stalk just above the bulb until it becomes soft and distorted, and the onions, which come up with the slightest pull, *are worthless.*

Mr. M. V. Slingerland forwards two bulletins, Nos. 123–4, issued by the Cornell University Agricultural Experimental Station; the first deals with the green fruit worms (*Noctuidæ*), which are very destructive in many of the States, and though originally feed upon the forest trees, now attack many different cultivated fruits.

The second gives an account of the Pistol-case Bearer (*Coleophora malivorella*), a small moth belonging to the *Tinesdæ*, whose larvæ—like our curious case-moths—constructs a curious curved cocoon, and feeds upon the foliage of the apple-trees.

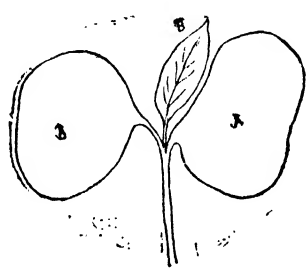
Forest Nursery and Plantation Work.

H. V. JACKSON,
State Forest Nursery, Gosford.

THE life of a plant comes into active observation upon germination of the seed, at which period it is described as a seedling, and the conditions necessary for its further development are light, heat, and moisture, together with suitable nutritive qualities of the soil. In the science of plant raising the original habitats of plants have to be considered, and by improving surrounding conditions productions of varieties of greater beauty and excellence may be arrived at than was perhaps usual when grown in a wild state.

The stem of a plant is that immediately above the ground, the stem and the root being the support for all the other parts of the plant, leaves, flowers, and fruit. Hard or woody stems are protected by the bark. If the stem branches close to the ground, and the plant is dwarf in habit, it is then a shrub; if the stem does not branch till it reaches a considerable height above the ground, and is extensive in its growth, the plant is a tree.

Upon the germination of a seed, the first one or two leaves to appear are called the cotyledons, these are followed by the typical leaf.



A. A. Cotyledons. B. Typical leaf.

Seeds usually contain two coats, the outer called "testa" and the inner "tegmen." The testa is often thick and hard, as in the case of hickory, walnut, and other trees bearing fruits which in common parlance are called nuts. On the outer side of the testa is the hilum or sear, the point of attachment of the seed to its stalk. Seeds of different plants vary greatly, from grain like fine dust to the large seed of the cocoa-nut. Pericarp is the general name for that portion of the fruit enveloping the seed; and according to the character of the pericarp, seeds are divided into dry, succulent, or fleshy sorts, and according to whether they open or not when ripe they may be dehiscent or indehiscent.

Fruits that break or open out so that the seeds fall out are dehiscent. The dehiscence may take place lengthwise or from top to bottom, breaking into several parts—it is under these circumstances said to be valvular—or it may take place transversely, opening like a lid, when it is a transverse or circumscissile dehiscence.

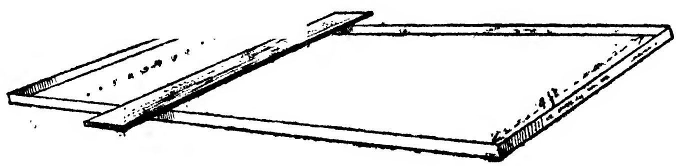
The indehiscent fruits are those which do not break up or open. and the layers of the fruit are always distinct. The inner layer of the fruit (endocarp) is hard, forming the stone; the outer layer (epicarp) is the skin, while the mesocarp is the succulent edible portion.

In collecting seed it is absolutely necessary that great care be taken to collect it only when fully matured; seeds collected before their time are bound to give disappointing results. There is such a wide difference in the keeping properties of seed that it is always necessary to use the utmost care and give the best of attention in this respect; winged seeds are usually very liable to deteriorate, and should, therefore, as a general rule, be sown soon after gathering.

In the case of our indigenous red cedar, Cedrela australis, the seed rapidly loses its germinating power. As yet, with the exception of perhaps certain vegetables, the business of seed farming is hardly attempted here. In some Government and private nurseries that have been established a number of years seeds of both exotic and indigenous trees are obtained, and nurserymen obtain a certain amount of plant seeds. In England and Germany seed farming, however, is carried on as quite an extensive industry, and the Americans also have made great strides in the same direction. A large proportion of exotic tree and flower seeds are imported to this Colony, and though there are occasional losses, yet on the whole the results of sowing are very fair.

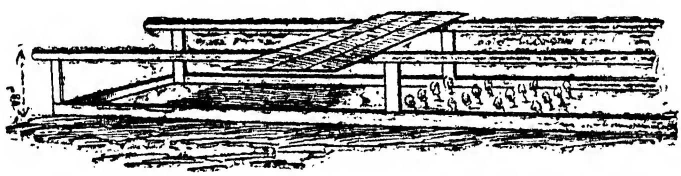
While some seeds are so light in texture that they soon perish, others require prolonged immersion in water to soften the outer shell. The period of germination varies very greatly, sometimes due to the nature of the seed itself, and at other times due to the physical surroundings of soil, moisture, heat or cold. In the matter of seed sowing, the depth at which they are sown should be in proportion to their size. When sowing, whether in the open or in nursery beds, it is generally much preferable to sow in drills rather than broadcast; the space between the drills will depend upon the nature and size of the plant. The advantage of spaces between the drills is that the plants have plenty of room, and weeds can be kept down conveniently, whether by hand weeding and Dutch hoeing or by use of the

Planet Jr. implements, as the case may be; air, light, and moisture have also a more direct influence. Sowing should be done when the ground is sufficiently dry to be of a fine tilth. In sowing exceedingly fine seed, requiring a very light covering of earth, after sprinkling the seed, cover it by means of light soil passed through a fine wire sieve. The plot should then be watered with a fine light spray. Care must be taken in the watering, or the seeds and their light covering will be washed up and the sowing spoilt. If the natural soil is of a heavy, stiff character it will be advisable to have prepared an admixture of soil and sand, and perhaps a little leaf mould, as a top dressing to the bed before sowing the seed. Where seed beds are frequently or continually in use it is well to have them edged with

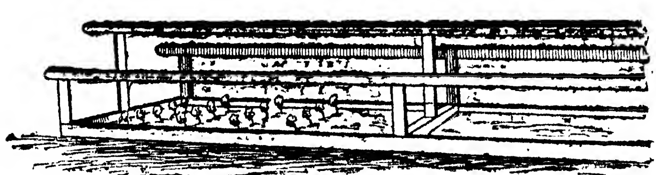


Seed bed enclosed by wooden edging (3-in. x 1-in. batten).

woodwork, and horizontal bearing bars along the sides, to carry shade hurdles whenever it may be necessary to shade either the seed, seedlings, or plants. In marking the lines for sowing the seed, a simple plan is to have a straight 6-inch board, an inch or two longer than the width of the seed bed. The board is placed across the bed, and having cut the small trench along the edge of the board with a spade, if for large plants or seeds, or having simply made a slight hollow impression with a stick, if for small seed, the board is turned over; and after sowing the seed or planting the seedlings, as the case may be, in this first line, the board is already in position to mark



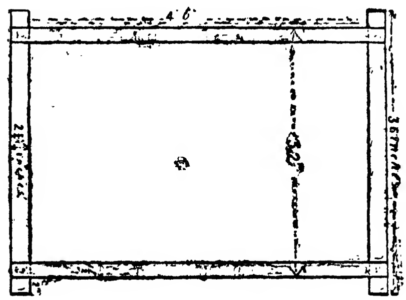
Seed bed with side bearers.



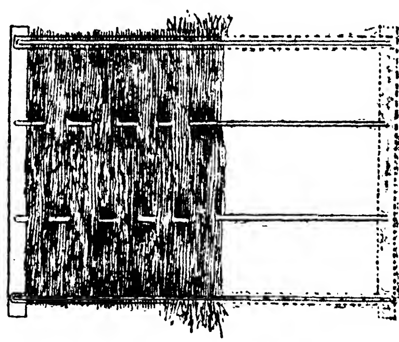
Seed bed with centre bearer for canvas shade.

the second line, if the rows are to be 6 inches apart. By turning the board over twice, or by moving it one way or another, so the lines may be made closer or wider as desired.

In some cases of fine seed sowing, after the seed has been properly sown, before watering, a piece of common fairly open scrim or hessian is pegged down evenly over the sown portion, and watering is then done over the hessian or scrim. This prevents any serious disturbance of the seed; but unless very great care is exercised in removing the scrim immediately the seed shows signs of germination, by the young plant appearing through the soil, harm will result. Careful shading is also necessary after removing the scrim from such close proximity to the plants. Close shading with tea-tree hurdles from the first is preferable to the scrim, as long as the watering is done sufficiently carefully. Where the tea-tree hurdles are used they should be removed before watering, in order to obviate the possibility of any drip which would occur if water were played upon the tea-tree. The hurdles are most satisfactory if the frames are made of either American red wood or Colonial red cedar. These woods are springy, durable, and light; and if of seasoned timber the frames will not bend or warp with sun heat.

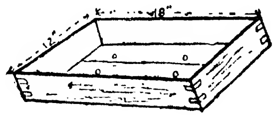


The two centre bands of hoop-iron are, first of all, permanently fixed, and as tight as possible; the tea-tree—which has been cut in the bush, somewhat longer than is finally required—is then placed in position, reversing the heads and stalks of the tea-tree as it is taken up for placing in position; the bands along the side bars are only nailed down as the work proceeds, and the operator is satisfied his material is in position, evenly distributed, and sufficiently thin or dense, as may have been decided upon. After the whole of the hurdle is set with bush-work, the tea-tree is easily trimmed to a distinct edge. Tea-tree intended for bush-houses or hurdles should be cut and then spread over the ground to dry for at least a couple of weeks before using.



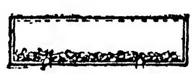
Seed beds and seed boxes should be so situated that the daily watering, when that is necessary, may be done conveniently, with the least possible labour, and in the most expeditious manner. It not infrequently happens that good and possibly valuable seed may be lost, and thus practically wasted, through the accommodation for watering being limited and inconvenient, and consequently out-of-the-way beds or boxes are inadvertently overlooked.

The most convenient size for a seed box intended for out-of-door operations is a box 18 inches long by 12 inches wide, outside measurement, made of 6 x ½ inch boards, consequently the box is 6 inches deep. Any well seasoned hardwood, such as tallow-wood, blackbutt, and blue gum, answers the purpose. If the boxes are not neglected red cedar stands very well and makes nice light boxes, but the hardwoods are of course the most serviceable.



The corners of the box should be strengthened by binding with one or two pieces of bent hoop-iron.

Drainage holes should be bored in the bottom of the box, and before filling with soil the box may be crocked in a similar manner to that usual in the case of pots. Good sized pieces of broken flower-pot are placed over each drainage hole with the convex side uppermost, similar crocks are placed over any other opening, such as the centre join of the two boards forming the floor, and which may have shrunk so far as to leave an open crack ; having crocked these openings, then comes a layer of charcoal, or small broken pieces of pots, or of pebbles, or small rough stones; this layer may be an inch to two inches deep, and the object in view is to secure good and efficient drainage. The coarser qualities of the potting soil may be now spread over the crocks, and as the box is gradually becoming filled, the higher layers of soil may be somewhat finer and more friable. It is not advisable, however, to have a body of very finely sifted soil in a seed box, as the absence of coarser substances and fibres leaves it with a tendency to "sodden" with watering, and afterwards it will cake hard in the dry weather and powerful sunshine. The depth of soil will depend upon the nature of the seed and the probable rooting character of the expected plant, but the box should not be filled higher than within half an inch or an inch of the top. Having filled the box to the desired height, and the soil being of an even level and fairly moist, the seed may be placed in position, and set firm under gentle pressure with a flat piece of board, which with a peg driven in the centre for a handle answers well for the purpose. The seed being so set and evenly distributed, some fine soil may be sifted over until the seed is considered to have been covered sufficiently, then water gently and place the box where it is to be in position until results are forthcoming.



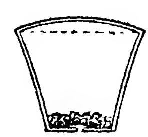
The potting soil to be used in filling the boxes should have been watered and turned over thoroughly, if not the night before then at least several hours before using, and while fairly moist it should be still free and friable, and pass through the hands without being sticky. The box being sown it may now be placed in position alongside any others already sown, in a place set apart for them, and so constructed that they can be conveniently shaded and watered. An unused seed bed with bearers and tea-tree hurdles, as shown in example No. 2, will answer, or the side of a shed or bush house, in which latter case a roller hessian blind answers well. When the seedlings in the boxes reach a stage where they no longer require shading, but will benefit by moderate exposure, the boxes should be taken out of their present location and placed in some sheltered warm corner where they will get rain, dew, and sunlight, but will not be in a severely-exposed position.

Seed boxes should never be laid on the ground, but should be stood upon even blocks of wood, stone, or brick; bricks are preferable, being a convenient size and handy to move about. The boxes should also be perfectly level, otherwise, heavy rain or watering is apt to wash the top dressing and seed all to the low level side of box. Where a number of seed boxes are being put out, it is most expeditious to lay the bricks at their level preparatory to filling the boxes,—a boy with a spirit level and empty box will soon do the work if it is desired to be very exact. Seeds may be sown about March, and with fair success the seedlings will be fit for potting in September, and in that month another lot of seed may be sown from which the seedlings will be fit for potting in January.

Where stiff heavy soil is characteristic of the locality it is necessary to use good sharp sand when mixing up a compost for seed sowing and potting of plants. The quantity of sand in the mixture will depend first upon the original nature of the soil and secondly upon the nature of the seed; a large seed such as that of Castanospermum australe, the Moreton Bay Chestnut, may be sown in a heavier compost than that used for the light seeds of the coniferous or eucalyptus orders. The length of time seedlings may remain in the boxes depends upon circumstances. Seedlings of deciduous plants had better not be removed until they have shed their leaves in the usual way, at which period they may be rowed out or planted out, or if desired they may be placed in pots.

Evergreens are best potted during cool weather, and, therefore, advantage should be taken of wet and cloudy days for this work; and especially is this necessary when handling seedlings of eucalyptus and acacia species. For general potting operations the spring months are the best.

Flower or garden pots are made in a variety of sizes from so called "thimbles" and "thumb" pots, and 3 in. and 4 in. up to 18 in. In forest nursery work the "thumb" pot and 3 in. and 4 in. are most in demand. In preparing the pot for use, a "crock" is placed over the drainage hole, and then a layer of broken charcoal or broken pottery, on top of which a layer of coarse potting soil is run in. The soil should be moist, yet free and friable, as described in the case of the seed boxes. A little soil being already in the pot the seedlings should be held in such a position that the roots will be evenly distributed as the balance of the soil is dropped into the pot. As the soil passes into the pot it will help to sustain the young plant in position, and the soil should be firmly pressed with the fingers. The base of the stem should be just below the rim of the pot, and the soil should not be filled up flush with the very edge of the pot, but a margin of pot left, thereby providing for the retention of a small quantity of water when the plant is watered, but which will simply flow off if the pot has been filled too much with soil. In potting into large pots, the soil should be coarser than that used for the very small pots. When the potting is completed the plants may be watered, in order to settle the soil, and they should be allowed to stand for a while to drain before moving. Finally they will be placed in an airy bush-covered shed, and if likely to be transported early for use, when the plants appear to be established they may be transferred to a plunge-bed, where they will have to brave the elements, and so become hardened. Some discretion is necessary when potting in regard to the size of the pot to be used. A very small seedling placed in too heavy



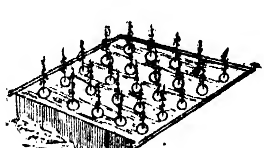
Section of a pot with crock drainage material in position.

a body of enclosed soil, through the use of a pot a size too large will, in many cases, not thrive, and it is then described as being "overpotted." Where plants have been on hand for a considerable time, they will require re-potting. In performing this operation the pots are prepared in the usual way. Upon turning the plant out of its original pot, the old crocks adhering must be carefully removed without injuring the root, and any sodden sour soil or fungus growths with which the roots are hampered must be removed. The plant should have been well watered some time before removing; for, if the ball is dry, it will not readily obtain moisture when surrounded by the new and more porous soil. The new pot should have sufficient soil in it to bring the plant to a proper level upon putting the old ball of roots into the pot. The space between the ball of earth and the sides of the new pot will be filled in gradually with potting soil, and worked down by occasionally bumping or jarring the bottom of the pot upon the table and pressing with the fingers or thumb. In cases where the ball is a close fit to the sides of the pot, and the soil will, consequently, not readily pass down between, it may be helped by means of an old thin label, but it is not advisable to "job" the soil with a blunt stick, as the roots are apt to be either cut or bruised thereby. The pots, if not new, should be thoroughly washed before using. If plants are potted into dirty pots, when the time of shifting arrives the roots and soil will be found sticking to the pot, and to remove the plant it will either have to be torn out, thereby lacerating the roots, or the pot must be broken.

In potting, if the roots happen to be matted, it will be advisable to gently disentangle or open them out. If potting seedlings, great care should be taken when lifting them either from the seed bed or box not to break or cut the roots or fine fibres; the greater care taken in this respect the more successful will the potting operation turn out. This is especially necessary when dealing with eucalypts, acacias, and the pepper tree, and varieties of the conifers.

The general work of potting varies very considerably. Some plants require gradual advancement from the small to larger pots, while others will bear frequent removes and into larger sizes; then, again, some plants require firm potting, while others must be more lightly treated. These are points which can only be learnt satisfactorily by practical experience. In potting very small seedlings into small pots, the soil should be light and free; and as the small pots hold less moisture, so also do they dry the sooner, and consequently they require frequent and careful attention in regard to watering.

In this hot and dry climate a system of "plunging" plants in pots is frequently adopted, with the object of hardening the plants, and also as a saving of labour in the matter of watering, &c. If the summer season is advancing, care is requisite in removing plants from shelter sheds to plunge beds, or they may burn severely, and so be checked in their growth; dull days and damp are therefore the best. With pots that have been in exposed situations previously to plunging it does not matter. Generally, a plot is set apart for a plunge-bed, but when that is not the case, any vacant place or unused seed-bed will answer. The pots should be well watered and then rowed out in trenches, cut with the spade or trowel to the necessary size. Having inserted the row of pots, the earth pulled back to make the hollow

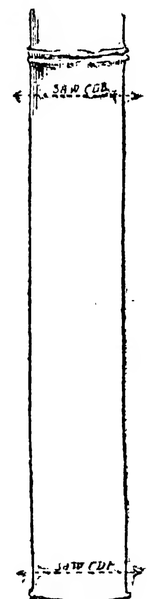


Plunge bed.

or trench is dropped back again round the pots, and lightly covering them. The pots are by this system kept cool, wind does not play upon the pot, and they are always more or less moist.

In 1890, Mr. J. Ednie Brown, the then Director of Forests in New South Wales, introduced a system to this Colony of growing certain species of timber-tree seedlings in bamboo or cane tubes made from the giant reed. As it is a system most useful, inexpensive, and which will be highly adapted to the needs of this Colony when planting is gone into systematically, especially in connection with the growing of eucalypts, a description of the process, as recommended by Mr. Brown, may be given here.

The *Arundo donax* is a tall evergreen bamboo-reed of South Europe and North Africa. Flowers reddish, in numerous spikelets, forming a large, compact panicle, 12 inches to 16 inches long. Leaves alternate, lanceolate, acute, large, and ornamental, glaucous green. Height about 12 feet. It prefers deep, low-lying spots for quick and rapid growth. The roots should be planted during the winter season in rows 3 feet to 4 feet apart, and the ground should be cultivated occasionally. The second year's growth will generally be found suitable for the purpose of seed-sowing.



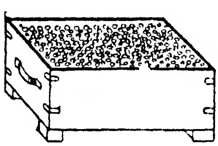
When the reeds are considered sufficiently large for the purpose, they should be cut and stacked until they have dried and hardened, after which they may be cut to about 5 inches in length. When cutting them, the knots or junctions should be left off, and this operation should be done twelve months before the tubes so formed are likely to be used. They can be cut with a sharp hand-saw; but at the Government Forest Nursery, at Gosford, a small circular saw, worked by hand-power, is used. If it is necessary to use reeds of such a growth that the joints cannot be avoided, the woody matter inside can be pierced by forcing a long pointed iron through each tube until it is perfectly clear. In laying the tubes for sowing, the following are the directions:—Beds about 4 feet broad, 9 inches deep, and of such lengths as may be required, are laid out in the nursery ground, with sides and bottoms of concrete or boards; these must be properly level. An inch or two of soil should now be spread upon the bottom of the bed, and the tubes then taken one by one and packed tightly together until the bed is full. A piece of board as a leveller is then used to force the tops of the tubes to a common and even level surface.

Fine soil, perfectly dry, is now filled into the tubes by riddling with a sieve. While this is being done the tops of the tubes are beaten with a light, smooth mallet, until the soil is shaken down; for if the tubes should have the appearance of being filled, and yet be in places hollow, after sowing and watering there will of course be a collapse, and consequently loss of seed. The tubes being properly filled, they are sown by dropping two or three seeds into each tube, after which more fine soil is sifted over the whole to the depth of about a quarter of an inch, until the tops of the tubes are

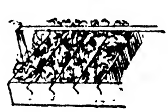
completely covered. Then the whole should be watered with a fine spray, and the spraying repeated every evening. The bed should have side-bearers, as already described in connection with seed-beds, and tea-tree hurdles should be thrown across to shade the whole until the seeds have germinated and are growing strongly. The shades should be removed every evening, and also during wet weather. In the event of very wet weather or heavy rains, a tarpaulin, or sheets of iron, should be placed across; otherwise the heavy drops will sputter the seeds out of the tubes. As the seedings reach a height of half-an-inch or more, they should be thinned out to one strong seedling in each tube, from which time they will grow into sturdy plants fit for planting out.

Where small quantities only of eucalyptus seedlings are required—say, 2,000 or 4,000—it is sometimes convenient to set the tubes in cases, such as empty gin-cases or even larger cases that are not too deep. The writer has several times adopted this plan with advantage. The cases can be moved into various situations for shelter or sunshine, as the case may be; and if the plants have been grown on the area where the planting is to be done, there is no unnecessary packing, &c., but planting may be done right away.

The preparation of a box consists in the first place of boring a good number of drainage holes in the bottom; these holes are crocked in the usual way, then a light layer of well-broken charcoal so that it be not lumpy; over this a level and even layer of soil to the depth of 2 or 3 inches. Then set the tubes tightly as already described in the setting of a bed, and with a flat piece of board press the tubes to a common level. When satisfied that no more tubes can be inserted, the fine dry soil is sifted into the tubes and beaten steadily as before mentioned. When the tubes and interstices appear full of soil, the writer has made a practice of watering the box lightly, but persistently, and then leaving it for some hours to drain. If any tubes are not full of soil, the moisture carries it down. After the box has drained, those tubes which proved not full of soil can be filled, after which sowing can be proceeded with. Seed having been placed in every tube, fine soil is sifted over the whole, as in the case of the pit, and then watered with a fine spray.



In despatching tubes in cases per rail, owing to the manner in which cases are knocked about and turned over on long journeys, the plan adopted at Gosford has been to tie the tubes firmly with strips of canvas in tens or



Bundles of tubes in position in case.

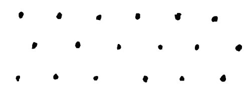
Case of tubes packed and covered.

twenties, and then set the bundle in a box, when string is run across from side to side, thereby tying the bundles down without injury to the plants.

When planting tubes they should be well and firmly set, with the top of the tube about 1 inch below the ground, so that after rainfall, upon subsidence of the disturbed soil, the tube will still be barely level with the top of the ground. If this is not attended to, the tube in course of time is visible

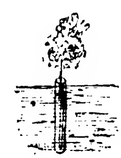
above the ground perhaps a quarter of an inch to 1½ inch. Under such circumstances the plant suffers from wind and sun-heat, and the plant probably perishes. If properly planted the tube retains its moisture. It is cool and is gradually rotting as the plant is making growth.

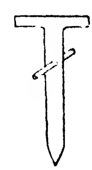
Upon cessation of the first rainfall after planting, it is advisable to inspect the planted tubes. The plants should be put out in rows on the quincunx principle—*i.e.*, the trees of one row coming between the trees of the next row.



Where planting is being done on a properly cultivated area—*i.e.*, where the plough and harrow have well pulverised the soil—the planting of tubes is rapidly done.

One man prepares the ground where the plant is to be set and drives a spade its full depth perpendicularly, thereby making a sliced hole into which the tube will drop; another man, following with the tubes, sets each tube deep enough and perpendicular, fills in some of the fine top soil with a trowel, pressing the soil well down as he does so. In the meantime the first man is preparing the next hole for the following plant. In very free ground the tube may be set by one man with the aid of a dibbler. The dibbler should be a shade thicker than the tubes in use, and when driven into the ground should go down, say, a quarter of an inch further than the length of the tube. The dibbler should not have too fine and long a point to it, but must just be pointed enough to pierce the ground readily. In the upper end of the dibbler are gauge-holes into which a peg is fixed giving the depth at which to stop driving. A dibbler made of a piece of round bar iron, well finished off to a smooth surface, is the best, as the earth does not stick to it so readily as in the case of wood being used. Where a tube or tubes appear to be very thick, hard, and dense, the planter should insert the point of a knife-blade sufficiently to split the tube down one side.





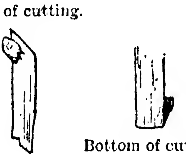
Next to seed-sowing the most common mode of raising plants is by striking them from cuttings, and to succeed satisfactorily it is necessary to learn by practice and experience the different means of propagating plants in this manner, according to their respective peculiarities. Plants are not all alike in the matter of rooting from a cutting, and they may therefore be divided up as follows:—

Plants that strike—*i.e.*, roots—from young shoots.
" " half-ripened wood.
" " a leaf with a bud at the base.
" " offsets from the base of old plants.
" " leaves or portions of leaves.
" " cuttings of the roots.

Soft-wooded plants—*i.e.*, hardy flowering plants—as also some hard-wooded shrubs and small trees, such as gardenias, azalea, lagerströmia, &c., may be propagated by placing the cuttings in pots specially prepared. The

usual necessary drainage being provided, a layer of soil suitable to the plant is put in the pot, then a top dressing of clean silver sand; the pot being watered and allowed to drain, it is ready for the insertion of the cuttings. The soft-wooded plants and some hard-wooded shrubs require a higher temperature to cause them to "strike", hence the application of bottom heat by artificial means. In connection with the raising of plants by artificial heat, this pertains more to gardening than forestry. Length and size of cuttings depend on the variety of the plant. Coniferous plants, such as thuja, retinospora, cryptomeria, and varieties of hardy deciduous trees, may be raised from cuttings. These take longer to root and are not subjécted to heat. The evergreens are placed in what is termed a cold frame, or some prepared bed in a special suitable cool place. Hardy deciduous trees, such as ash, poplar, mulberry, plane-tree, box, elder, &c., are readily raised from cuttings in suitable ground. The cuttings of these deciduous varieties should be about 9 inches long, and may be sowed out in open breaks. If the plants are for early removal, 2-feet rows may be adopted, and the cuttings placed 6 inches apart. If the ground is not required for future cultivation, and it is intended to leave plants permanently on the site, the rows should be 3 ft. or 3 ft. 6 in., and if rooted plants are required later, by lifting the plants from between every one that is 3 ft. or 3 ft. 6 in. apart, the nucleus of a coppice or plantation is left. In making a hardwood cutting, the point of the cutting should be above an eye or bud and slanting; the bottom of the cutting should be close under an eye or bud and cut straight.

Point of cutting.



Bottom of cutting.

The trench for the insertion of the cuttings must of course be a full 9 inches deep. The cuttings being set in position, about one-fourth of the soil may be turned in, and set firm with the pressure of the foot. It is always essential that the cutting be well and firmly set, especially at the base. A further quantity of earth may be turned in, and further pressure given, after which the trench may be completely filled up, leaving just the one eye or bud of the cuttings free. In this climate, and especially if the soil is of a sandy, free character, the cutting is best set deep; it is thereby protected from hot winds, &c., and after rain, with the natural subsidence of the soil, the cutting will be quite sufficiently exposed at the point. If the soil is of a heavier character, the cutting must be set at the discretion of the operator, and taking into consideration the local climatic conditions.

Some trees, so far as propagation by cutting go, can only be struck readily by cuttings from the root. Of large hardy varieties, elm, poplar, mulberry, *Robinia acacia*, plum and quince may be mentioned. Our own red cedar will strike from a root cutting, but it would not be profitable to raise in this manner. The cuttings may be made into lengths of 3 or 4 inches, and rowed out in lines in a nursery bed.

Cuttings of single eyes, *i.e.*, buds, is another form of propagating, commonly adopted in raising vines. The branches are simply cut into short

lengths, each bearing a well-matured bud, with a short portion of the stem extending each way. The eyes are planted just below the surface of some light soil, in a pot or box, which is placed in a hotbed or propagating pit of a forcing-house.

Cutting with bud.

Where the potting of plants is carried out on an extensive scale, it is advisable to have a few heaps of soil on hand, and as the stock runs down to make up a reserve heap or heaps. At the Gosford Nursery no refuse is allowed to go to waste, all road sweepings, leaf mould, soft-wood prunings of ornamental plants, annuals finished flowering, &c., are carted away to a heap and left to rot. Heavier woody prunings from trees, undesirable rubbish, &c., is heaped and burnt, so that ashes are available. Stable and cow manure is collected and heaped separately. Surface turf is taken from a suitable spot and broken up roughly and left exposed to sun and air as long as convenient. It is then further worked over with the spade, and while being heaped, a proportion of material from the "rot heap" and "ash heap" is mixed through it. Old rotted cow manure is put through the heap if manure is required. The heaps are made about 20 ft. x 8 ft. x 4 ft., with a 2-foot space between each.

These heaps are occasionally turned over if there is any suspicion of sourness in the turf, but it should be borne in mind that the more frequently the soil heaps are worked and thereby sweetened, so also is the soil rendered more fine, *i.e.*, there is a breaking up of the nodules. When the soil is brought into the potting shed, according to the particular variety of plants that are to be potted, so is the soil graded to the quality required and made more porous by the admixture of good, clean, bright sand obtained from the vicinity of a fresh-water creek.

When trees have to be forwarded a long distance the work of packing the plants should be done with much care. In the case of deciduous open-rooted trees, when they are being lifted out of the ground, the earth should be dug up fairly wide from the tree in order to avoid cutting the roots; of course some of the roots may be cut unavoidably, but the more care taken the better. So soon as possible the roots should then be plunged into a clay puddle hole, whereby the whole of the fibres will be in a manner "painted" with the liquor. By this means the roots do not suffer so soon nor to so great an extent from exposure to the air

The varieties having been kept separate, after puddling, each variety will be tied up in a separate bundle, and then the whole of the bundles, if not too bulky, tied up into one despatch bundle. Damp straw, or other substance

Young trees "heeled" in the ground awaiting planting out.

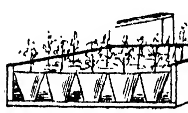
such as sea-weed should then be well packed in and about the roots, and, if necessary, straw should be also laid some distance up the bundle, above the root portion, to obviate the possibility of the bark and branches of the tree on the outer edge of the bundle being broken and chafed in course of transit. Upon arrival of the plants at their destination, if not planted at once, then

they should so soon as possible be unpacked, opened up somewhat, and laid out in a trench formed for the purpose in a cool and sheltered situation, the roots watered, and earth thrown back upon them.

Each variety bundle should have a label tied to one of the trees, therein showing distinctly what each bundle contains, whether it be ash, elm, oak, or poplar, &c. If proper attention is given to these directions there will be few, if any, losses in the planting of deciduous trees. Unfortunately it too often happens people are too busy at the time of arrival of the plants to give them the necessary attention. The writer on more than one occasion in the back country has seen bundles of plants intended for church grounds or other public purposes left about for days in the sun and wind before being either watered or planted ; as a consequence few of the plants grew. In these cases too often the plants are declared either to have been no good or the season was unpropitious, the real cause of failure never being admitted.

Plants in pots should be packed in cases with moss or straw, or light dry sea-weed. The pots should be well watered before packing. There are three ways of making up a case of pot plants, viz.:—

1. Pots packed in a shallow box holding one layer.
2. „ „ deeper box to hold two or three decks or layers.
3. „ „ case longitudinally.



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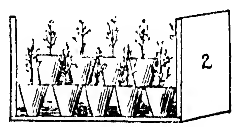
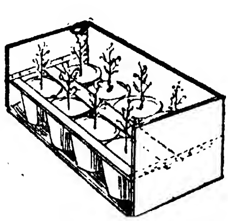


2

At the Gosford Forest Nursery, plants are always packed on the first or second plan, as being safer and better. Plants packed on their sides carry very well for short distances ; but if there is any suspicion of dampness in the packing, and the weather be very hot or the journey very long, the plants probably "sweat," and arrive at their destination useless. The same may be said in reference to packing bamboo tube plants. On one occasion some years ago, when employed planting, the writer received several cases of what had been splendidly-grown sugar gums (*Eucalyptus corynocalyx*) in tubes, but owing to the longitudinal packing, the heat *en route*, and the length of the journey, the consignment was very little good.

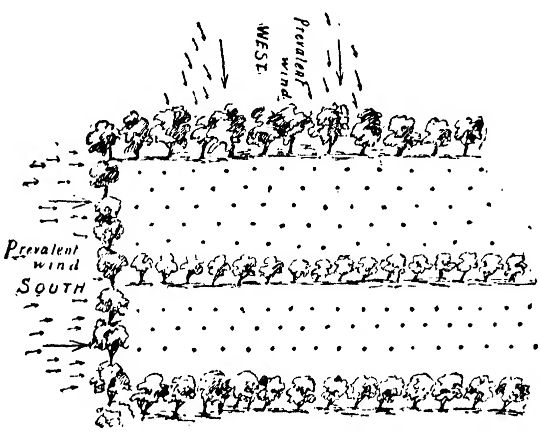
The taller plants are placed in the bottom of the case when a second layer is to be packed. When the pots have all been set nice and firmly, thin wooden battens, made of any straight split case lids, &c., cut the length of the width of the box, are dropped across each line of pots, and are fastened down by a cross-piece nailed along each side of the case, or in some instances each batten is nailed independently by driving a nail through the case from the outside to catch the point of the batten fitting close against the side. When plants are received packed and battened in this way, the most expeditious and safe way to unpack is to remove the canvas top and knock one side of the case off, whereby all battens are loosened from that side. When the case arrives



3

at the site for planting it is advisable to leave the plants in pots in the case, only removing the numbers required from time to time by the man planting.

Not only the choice of situation, but also the manner of preparing the site for a plantation requires very careful consideration in this country. Where 20, 30, or 50 acres are to be planted, people often go in for indiscriminate clearing of the area of such indigenous growth as there may be already upon it; but the wisdom of such action is somewhat doubtful. A great deal will, of course, depend upon the situation, but unless the area is small, and very closely protected by surrounding hills and forest growth,



probably the wisest course is to leave breaks of indigenous growths across the area in the direction that will be the greatest protection to plants against the most prevalent wind and storms.

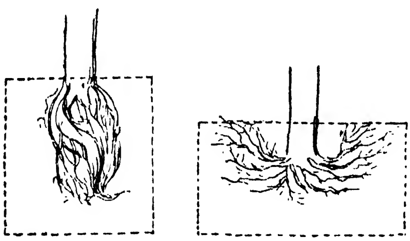
The width of such wind-breaks will depend upon the country to be planted, and likewise upon the nature of the natural bush—in some cases a 5-ft. or 10-ft. break may be sufficient, in other circumstances a greater width. When the plantation has become sufficiently established, the indigenous growths, whether they be trees or shrubs, may be removed, and the space so cleared in its turn planted. Portions cleared for planting should be thoroughly ploughed and subsoiled, and in fixing upon the position the possibility of good natural drainage should not have been overlooked. A low-lying, dead, sodden, cold bottom, in which moisture stagnates, is most unsuitable. The quality of the soil and peculiarities of the locality, in being favourable to particular varieties of trees, should be duly taken into consideration, and only those varieties planted that are suitable. If *Grevillea robusta*, the silky oak, luxuriates in that part of the country, and the soil and the situation is suitable, then plant largely of that tree. The same bears out in other districts particularly adapted to (say) red cedar in one case, or ironbark in another.

The very best plants should always be selected for these purposes, and they should be planted by careful men who take an interest in their work, and who are not simply endeavouring to cut the day out for the sake of the amount at their credit at sundown.

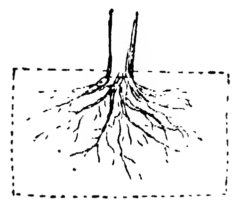
The land having been thoroughly subsoiled, ploughed, cross-ploughed, and harrowed, and, if possible, left fallow for a season and then again ploughed,

and, if necessary, rolled, and then once more harrowed, the holes may now be prepared for planting. For deciduous trees the holes may average 2 ft. x 2 ft., certainly not less than 1 ft. 6 in.; but if the trees are of such a growth that the roots require more room, then the extra space must be provided, for nothing is so harmful as "jamming" roots into a hole too small for the purpose.

As the holes generally require a little soil put back again to bring the tree up to its proper level, the stiff material that probably was obtained from the bottom of the hole should go into the bottom again, the better soil of the surface being reserved to place immediately under and about the roots. The trees should be planted a shade deeper than when in the nursery, about an inch down in the case of a good sized, well-grown tree. As the well-broken



Roots badly planted.

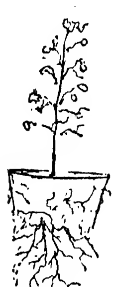


Roots properly planted.

soil is being gradually placed in the hole, the roots should be carefully spread so that they are in a natural position, and not matted all to one side, or forced against the main or primary root from the base of the tree, or turned at the points upwards, almost coming out at the surface.

The roots being properly spread and the hole filled, the earth should be firmly set by pressure of the feet, after which the subsidence so brought about will be levelled up with any loose soil remaining.

Planting out of pots requires as much, if not more, attention than the open rooted trees. The holes being ready, the planter knocks the plant out of the pot, by tapping the bottom of the pot with the fingers or the trowel handle, holding the pot upside down, with the stem of the plant between the middle fingers. The plant will, unless very dry, come out in a solid ball, whereupon the planter will remove the crocks adhering, and also a portion of the soil, to allow the lower fibres freedom. The plant may then be placed in position, care being taken to let the freed roots down, and spreading gently and carefully any laterals while the soil is being put in. Great care should be taken in avoiding breaking the fine fibres.



The matter of seed-sowing has already been treated upon to a certain extent, and there is not, consequently, much more to say in reference to sowing in a plantation. Our seasons are so uncertain in point of rainfall that the experiment with exotic varieties is precarious, excepting in truly suitable localities combined with a favourable season. With seeds of indigenous trees there is more prospect of results under any circumstances, provided the right variety of seed is sown.

The land having been treated as already described, and the top well harrowed to a fine tilth, a line is laid across the break it is intended to sow; the ground will probably require a little working by means of a spade and a flattening of the surface preparatory to laying the seed along the marked line. Of course the sowing will be at a depth corresponding to the size of the seed, as mentioned previously. The rows may be 3 ft. 6 in. or 4 ft. apart; if the seeds are large, they should be equidistant in the row from each other. Should very dry weather intervene, the ground should be kept cultivated by means of the Planet Jr. implements.

In a prepared area for planting, rows of 3 ft. to 3 ft. 6 in. are generally far enough apart; such width allows cultivation between the rows while the plant is small, and when once they are established and the young trees put on something of an umbrageous head, they shelter each other, the leaf canopy tends to keep down weeds and grass, and the tendency to make lateral branches being restrained, the growth is upwards, contributing to the production, ultimately, of straight and lengthy timber. Under some circumstances, and especially in moderately open forest country of a broken character where preparation of the ground by ploughing and subsoiling cannot be carried out, trees can only be planted according to circumstances, no hard and fast rule as to distances apart being possible; at the same time very wide planting, at distances of 15 ft. to 20 ft. or 25 ft., should be avoided. When planting under these circumstances, the holes dug for the trees should be wide and deep, the material—if of a very stiff character—should be broken up somewhat, and the longer the hole and the excavated material is left exposed to the elements the better. Upon partly refilling the hole preparatory to putting in the tree, be careful to put the material that came out of the bottom of the hole back again from whence it came.

At the present time, when the public interest and sympathy require awakening to forward the interests of practical forestry as far as practicable, the plantations should be near centres of population, and on the score of economy of working, skirting or at any rate as near the railway routes or shipping ports as possible.

In the coastal, central, and far western divisions of this Colony, the altitude, climate, and soil vary so greatly in their respective characteristics, that a fixed period for commencing planting operations cannot be laid down; the breath of approaching winter is felt earlier, and the spring is later in one section than in another; and then the season of plentiful rainfall or severity of drought is a factor that must be considered. In the case of deciduous trees, such as the oak, ash, elm, &c., the sooner they are planted at the fall of the leaf the better.

The eucalypts in pots or tubes, if they have been well hardened off in the nursery, may be planted in the early autumn, if seasonable rains are prevalent, or otherwise delayed till early spring. To a great extent the same holds good in planting pinus species. Where the rainy season sets in with any degree of regularity and certainty, early planting to catch these rains is advisable. During operations, when manipulating plants out of pots—or planting varieties in tubs—hot, dry, bright, or windy days should be avoided; in such times, the most should be made of the afternoon when the sun is losing its power, working in the cooler hours of evening as long as possible. Dull, damp days are always the best for planting, consequently on such occasions a push should be made to take advantage of the favourable opportunity, and the plants should always, if possible, be well watered after planting.

In forming plantations in this Colony, the planting of 1 acre or 2 acres properly every season, within what had been fixed upon as a plantation zone or area, and having the same acre or 2 acres temporarily fenced and properly attended to, until the plants in the block are established will be found to give much better results than does planting or partly planting a large area, and leaving it henceforth to take care of itself. By adopting this system, the successive acre or 2-acre block in each following season added to the No. 1 plantation block, will be partly temporarily fenced by the portions of fence removed from the end of No. 1, and as the work proceeds year by year, it is only a matter of time when, through the trees of No. 1 having become sufficiently large to no longer require protection, that three sides of its temporary fencing will be available for placing round a new and later additional block. Dependent upon the nature and progress of the trees, and the quantity of stock running in the vicinity, the earlier blocks may be unfenced according to circumstances at three, four, and five years. In the New England and similar climates, deciduous trees properly planted will not require so much attention, nor probably will trees planted in the luxuriant warm moist Northern River districts require such constant work and personal supervision as is necessary in some other localities. It is in the most exposed situations, and perhaps less kindly soil of the districts south of our somewhat tropical zone, in the cooler parts of the less favoured portions of the Eastern Division, and in the intemperate heat of the far western regions, that trees in plantations require the most care and cultivation until established.

During the season, from time to time, especially if dry weather is prevalent, the ground should be frequently cultivated or hoed. After rainfall, so soon as the ground is workable, the Planet Jr. cultivator should be sent between the rows, and in places where the ground has not been tilled the soil around the trees should be hoed.

Every plantation should be properly protected from stock and vermin by a proper fence. Where the rabbit is not ubiquitous, possibly hares are troublesome, and bandicoots, wallabies, and kangaroo rats play much mischief at times. A wire-netting of fine mesh is nearly always necessary round the fence. Where the block system of planting an acre or two at a time is adopted, the ordinary iron hurdle fencing should be most satisfactory. Such a fence is movable at any time, will not burn, and can be set up and taken down at a minimum of labour and expense. The first cost of such fencing is heavy, but the time and labour saved in erecting it, together with its being indestructible will more than repay the outlay in comparison with the labour entailed over the erection and frequent subsequent removes of ordinary fencing around a plantation, the boundaries of which, after the first year or two, will be continually changing for some ten or twelve years at least.

Marketing Citrus Fruit.

W. J. ALLEN,
Fruit Expert.

Oranges.

In picking oranges, care should be taken not to injure them, as bruises, however slight, will cause early decay. The fruit, for either shipping or keeping, should always be cut with orange clippers, leaving very little stem, and not pulled. Fruit should always be allowed to get fully ripe, and, if for local markets, may be allowed to hang on the trees after it is ripe; but oranges which are required for export should be picked only when ripe, and never before, as an orange picked whilst yet green never makes a good sweet fruit, and will not fetch as good prices on the market as that which has been allowed to ripen properly. Also, never pick the fruit whilst the weather is damp; in fact, if there has been two or three days rain on an orange it should not be picked for at least a week after, if it is wanted for export, as the rain tends to soften and swell the rind, and in consequence the fruit does not keep so well. After it is picked it is always well to allow the fruit to stand from three days to a week in a cool airy room, to get rid of some of the moisture in the rind, as it then becomes more pliable, and can therefore be packed more closely—this being a point of great importance to the exporter—as the fruit should be packed so that it will not become loose nor shake in the box during transit. Boxes should be uniform in size, and so constructed as to give free ventilation. The bushel-cases have been found to answer very well in Victoria, as they cost very little, and are never returned to the orchardist to carry diseases of all kinds. They present a neat appearence, and, by the thousand, made up, should not cost more than 7d. each in Sydney. They hold from 40 lb. to 45 lb., according to the quality of the fruit. The safest way, and in fact the only way, fruit of good quality should be packed for either the home or foreign markets, is to wrap each fruit in a tissue-paper wrapper (these being cut in different sizes to fit the different grades of fruit), and each box should contain fruit that is perfectly even in quality and size, and the number of oranges should be marked on the end of the case, as well as the kind, together with the growers name or brand. The boxes should be filled so that they have to be pressed down at least an inch to allow the top to be nailed on; but great care should be exercised in doing this, as any rough handling will break the wrappers and injure the fruit, whereas a gentle pressure will do no harm. Fruit should be kept in an even temperature, as if subjected to extremes of heat and cold, the best handled fruit will not keep. Those growers who always grade their oranges, putting only good fruit, neatly packed, into clean boxes, will soon make a name, and will always be able to sell at a fair price, whilst the careless grower, who does not take trouble to market his fruit in a neat and presentable manner, will find no sale if the market is glutted, or will have to sell at such a low price that it will not pay for the handling.

I would strongly advise all growers to watch the markets, and not rush their fruit on while the prices are low and demand small. There is not sufficient fruit grown in the whole Colony as to make it necessary for any person to sell at a low and unprofitable figure; and I consider that carelessness and neglect to look after and attend to the wants of the orchard in the way of cultivating, manuring, keeping down diseases, and careful handling and marketing, has most to do with the dead and dying orchards now neglected and allowed to die out with the excuse that fruit-growing will not pay For the man who does not wish to work, nothing *will* pay; and it is only the industrious, thrifty, and intelligent orchardist who can hope to make a good living from his orchard.

Lemons.

The same directions as given for oranges will apply to lemons, so far as regards care in gathering and handling, in order to prevent bruises or injury to the fruit.

If required for keeping, lemons should be picked as soon as they are three-parts coloured, as I have found from experience that they keep better and make the best lemons when not allowed to hang until they are too ripe. I do not say that a ripe lemon, picked when it is fully coloured, will not keep, as I have kept them for six months without losing more than 5 per cent.; but when they are to be stored they keep much better, and there is usually a less percentage of loss, if they are picked when from half to three-quarters coloured. Another point in favour of early picking is that the skins are not so thick as if the fruit is allowed to hang until over-ripe, and when the lemons are cured they will be found full of juice of the best quality.

Before putting the fruit away in boxes, trays, or whatever it is to be stored in, it should be allowed to stand for a fortnight in the shed or packing house to get rid of any moisture in the rind before storing away closely. The essential points of a good lemon are thin rind, very little pith, and an abundance of juice; and I think the climate of Australia particularly adapted for producing fruit with all these qualifications, as, with good attention, I have found the lemons here rather above the average.

In picking the lemons it will always be found necessary to go over the orchard three or four times so as to get all the fruit of the same degree of ripeness and size—that on the inside and shaded parts taking longer to colour than that on the outside—and with the larger fruit picked, the smaller has a little longer time in which to fill out.

As a matter of course lemons gathered as recommended are not fit for immediate marketing, but must be kept in store until they are a good colour. If wanted immediately, they should be exposed to the air until they are fit for market; if for keeping, they should be packed away as soon as they have thrown off the moisture from the rind, and with as little exposure as possible. It is very desirable to have a perfectly dry, cool place, with an even temperature, in which to store the fruit, and, where it can be, as nearly as possible, excluded from the air, and certainly never in a place where a current of air can reach the fruit, as this will tend to wither it up, and eventually it becomes small and hard.

A cheap and good way of keeping the fruit is to put it in sweat-boxes 3 ft. 1 in. x 2 ft. 1 in. and about 9 in. deep, and these can be filled about two-thirds full and stored one on top of another, or, if it is desired to keep each layer of fruit separate, each of these sweat-boxes is capable of holding three

wooden trays 3 ft. x 2 ft., with $2\frac{3}{4}$ in. cleats nailed on each end of the tray, which, when one tray is placed on top of the other in the sweat-box and the latter piled one on top of the other, say six or eight high, in a dark room, will keep with very little loss for six months. The advantage of this way of stacking is that the fruit does not press together, and if a lemon should become rotten it will not damage any of those around it, as is the case when trays are not used. After the first expense of buying the sweat-boxes and trays, they will with proper care be used for ten years. I must again impress on the grower the necessity of having a perfectly *dry* store-room, as well as one which can be darkened and kept at an even, cool temperature; and fruit must not be stacked on the ground, as the tendency is to draw up the moisture from the latter, thus damaging the bottom layers.

As a matter of course some of the lemons will spoil, and it will be necessary to look through them every two months at the beginning, and every six weeks at the latter part of the season and pick out all decayed fruit, which if allowed to lie would spoil others by contact.

In addition to being able to market the fruit in the best possible condition, this mode of treatment will enable the grower to keep it until it will bring the highest price. Fruit will shrink considerably, but not more than 10 per cent.; but as it gains in value by keeping, he is more than recompensed for any loss in weight by the higher price which cured fruit always brings.

In packing, care should be taken to wrap each lemon in tissue paper and place them firmly in the box so that they will carry a good distance without loosening and moving. Fill and press the box in the same way as described for oranges.

The Strawberry.

W. J. ALLEN,
Fruit Expert.

This berry is one of the most wholesome of fruits, and is to be found in the temperate zones of Europe, Asia, and America; and I am sure that were its medicinal properties better understood, the strawberry, instead of being grown by a few, would come to find a corner in every fruit-grower's orchard. It is a fruit which even the most delicate person may safely eat; and for table use, with cream and sugar, is one of the few dainty dishes of which the public never grow tired. The confectioner finds use for it by communicating its flavour to ices, and a most grateful and refreshing drink for hot weather can be made from the juice of this fruit mixed with water and sweetened, and flavoured with a little juice of lemon; in fact, its uses are too numerous to mention.

The plants are easily propagated, as, with the exception of one or two varieties, they all throw out runners, which are usually taken for planting-out new beds. The best time to take them from the parent plant is either in the spring or autumn. Personally, I favour planting about the latter part of February, as the roots will then get a good hold of the ground, and by the next summer make very fine plants and bear considerable fruit. I would strongly recommend the planter renewing half of the area under strawberries every year, as by this means he will always have beds in the most thrifty condition—this especially in the warmer districts, where water is not available, and where long summer droughts are common.

The best soil for strawberries is a rich red loam. It must be deep, and, if the aim is to grow the largest and finest fruits, the soil, if poor, will need to be well trenched and manured; this, with plenty of water and attention, is essential if the gardener wishes to make a success of his undertaking. The plants require plenty of sun, and should not be planted too close to high hedges or under spreading trees, as they rarely do well in such places. In planting, the rows should be at least 2 feet apart, and the plants themselves from 1 to 2 feet apart, according to the kinds and the growth of the vine. The runners must be kept down by cutting them as often as they appear. In many cases this will ensure a good second crop of berries. The ground must be kept in good order by constant dressing, and there are very few places where a yearly dressing of stable manure will not be beneficial. Strawberries remove from the soil soda and potash in large quantities; consequently, fertilisers rich in these substances are very necessary. In soils where there is a deficiency of lime, the superphosphate of lime, at the rate of about 2 cwt. per acre, will be not only a good fertiliser, but will help to keep down insects of many kinds.

Before setting out the young plants in position they should be steeped in a bath of tobacco-water, with a little Paris green mixed—the latter, say, 1 lb. to 200 gallons of water. Plunge the plants into the mixture, and,

without washing them, they can be planted in the position in which they are to remain. To prevent the eggs being deposited, and to destroy both the beetles and grubs, to which the strawberry is rather prone, must be the object of the grower, as in every case prevention is better than cure. Before planting the new bed the roots should also be trimmed, thus causing the plants to throw out more fibres.

As soon as the fruit begins to form, it is advisable to cover the ground between the plants with a layer of short grass, fine straw, or any material that will keep the berries clean, as, if not protected in this way, they are apt to be more or less dirty.

Beds laid out as I have described—planted in rows and with the runners kept cut off—will grow the very finest flavoured berries and sweeter than those in crowded beds. With rows 2 feet apart there is plenty of room for picking without damaging the berries or the vines.

The fruit should be gathered either in the early morning or evening, and not while heated with the sun. Care should be taken not to pick while damp, and do not handle more than is absolutely necessary, as the fruit being tender is easily injured, and it should never be heaped in masses. The best practice is to pick and place the berries into the receptacles from which they are to be sold.

Strawberries are frequently attacked by minute flies, varying in colour from green to brown, black, and white, they appear at different seasons and cluster thickly on the plants from which they extract the juice and close up the pores with their excreta. A syringing with strong tobacco water or soft-soap and kerosene will be found very effective.

If caterpillars are troublesome, which they sometimes are in the early part of summer, dust the plants frequently with finely powdered lime and soot. Soot is more lasting in its effects than lime. If weevils or beetles make their appearance work the ground well, also dusting a little lime over the plants and ground.

The plants are very often attacked by a fungus, such as leaf blight, mildew, or rust. As soon as any sign of leaf blight is detected remove all affected leaves and burn them. In this way it is quite possible to get rid of the pest if dealt with in an early stage. Also, spray with a solution of sulphate of iron, mixed in the proportion of 1 lb. to 5 gallons of water. This will also be found beneficial for mildew. Rust does not usually make its appearance until late in the summer; consequently, the plants do not suffer until after the fruit has ripened. It appears in minute yellow spots and usually on the upper side of the leaves. If plants are not badly affected the sulphate of iron solution will remove the rust, but if badly affected it will be best to remove the leaves and destroy them by burning.

The following are a few of the best varieties, which have been found to thrive equally well in either the cooler or warmer districts of Australia:—

Trollope's Victoria.—A recently introduced English variety and one of the best for most parts of New South Wales. Fruit large, roundish, ovate, and regular in outline; skin deep bright red; flesh pale red, tender, juicy, with a pleasant slightly sub-acid flavour; plant vigorous and bears freely and regularly, and can be depended on more than any other kind, and it will adapt itself well to various soils; it ripens early and comes in immediately after "Edith" and "Marguerite."

Edith.—An excellent and very popular variety. The fruit is large, well coloured, and has a rich, pleasant, slightly sub-acid flavour; plant strong, very hardy, and prolific and can always be depended upon for a crop; it can

be grown successfully in most soils and situations and comes in very early, the fruit of this variety being generally first in the market.

Marguerite.—A well known and popular variety with very large conical or cockscomb-shaped fruit which ripens very early; skin bright shining red; flesh white, tinged with pink, firm, moderately juicy and sweet but lacking a high flavour; plant robust, hardy, and bears freely; this is a favourite kind on account of its earliness as also because the fruit being firm it carries well.

The Captain.—A comparatively new variety with large, ovate, regular fruit, sometimes inclining to cockscomb, and which ripens early; skin pale red; flesh pale, firm, with a brisk pleasant flavour.

Filbert Pine (Myatt's Seedling).—An excellent late English variety, with berries rather above medium size, conical and occasionally cockscomb-shaped; skin dull purplish red; flesh white to pale pink, firm, rich, and briskly flavoured with a fine aroma; plant vigorous, hardy, and very prolific; this kind has also the reputation of being suitable for very light soils where some of the other varieties will not thrive.

Sir Joseph Paxton.—An excellent early English variety with large roundish berries; skin bright glossy red; flesh pale red, firm, rich, and highly flavoured; plant strong and productive.

Princess of Wales.—This is an excellent very early English variety; fruit large, cockscomb-shaped, and corrugated; skin deep red throughout; flesh tinged with red, tender, juicy, and has a rich pine flavour; plant vigorous and prolific.

The Passion Fruit

W. J. ALLEN,
Fruit Expert.

THE passion-vine does very well in almost any soil; but, like many other plants, will grow best in a rich red loam, and repays the planter in this soil by its increased productiveness. The best site for a plantation is a well-sheltered spot, so that the plants will not get blown about in the wind. If the situation in which they are to be planted is exposed, the best means of starting them is to drive three stakes into the ground, each about a foot from the young vine, and tie around the outside a piece of hessian or bagging. The vines in this way will have plenty of room to grow, and the hessian protects them from the wind and sand. They will not thrive in the colder districts where heavy frosts prevail, as the latter damage them very much, in most cases killing them outright. The three varieties which are said to do well in New South Wales are the *Passiflora macrocarpa*, *Passiflora maliformis*, and the *Passiflora quandrangularis*. The *Passiflora maliformis* (the sweet calabash) requires to be planted in a very warm situation to bring the fruit to perfection; but with the *Passiflora quandrangularis*, which is a vigorous growing plant, it will prove both very profitable and ornamental.

I have always found that, where protected, they did well on a 4-wire fence about 5 feet high, the rows running north and south, so that they got the sunlight on both sides, 10 feet by 8 feet apart, which gives plenty of room for cultivation. The trellis rows to be 8 feet apart, thus giving the vine 10 feet on which to run. I consider the best manures to be used are horse and sheep manures, as they are lasting, and give the plant a good healthy colour. It is also advisable in most soils to use a little lime, as many soils are deficient in this substance. As the young plant grows the branches should be tied to the wires until well established, after which they will not give much trouble. Care should be taken to prune out all worthless and dead wood every winter.

When the fruit begins to ripen it should be picked at least twice a week. It will keep well in a cool dry place, but I would recommend marketing every week.

Phylloxera and System of Inspecting Vineyards.

M. BLUNNO,
Viticultural Expert.

From time to time the question of phylloxera of the vine reaches fever heat, every new discovery of the pest exciting those vignerons who are unlucky enough to be in the vicinity of the infected area; but the growers generally sympathise with any provision directed to the safeguarding of the public welfare, and are almost invariably ready to assist those who are engaged in putting into effect these provisions.

Vine inspectors have been often illtreated in Europe when a service of inspection of the vineyards, and of destruction of the infected ones, was first started; sometimes they have even been surrounded by an excited gathering of growers and compelled with their gang of labourers to retire from the vineyard until a military rescue arrived to protect them and allow them to work.

In this Colony things are taken more calmly, the inspections being carried out by one inspector accompanied by a man; so that it is not a big gang of men, as is necessary in those vine-growing districts of the Continent, where the vineyards to be visited are very large and numerous, and the inspections have to be completed within a rather limited time of the year (from June to October), on account of the climate and of the system of growing the vines, which sometimes are mixed with other crops.

In New South Wales inspections can be made even in winter time, owing to the almost uninterrupted multiplication of phylloxera on account of the mildness of the winter. Here vineyards are very few compared to the area planted with vines in those countries of Europe suitable for their culture; so that one inspector with a man can do a fair amount of work and inspect a good many vineyards.

But in spite of the innocuity, or even of the usefulness, of these visits of inspection, there is in some few cases amongst the vinegrowers of the infected districts, if not an open contempt, a niggling and suspicious attitude towards them, in the belief that inspectors help the spread of the pests with their visits. If such vinegrowers would only take the trouble to follow these officers in their daily task, they would see how carefully the work is done, and the many precautions in examining the roots of the vines and treating the infected ones.

In the same way that medical men could not check a contagion unless they came in contact with the sickened people, so vine inspectors cannot retard the spread of the insect lest they come in actual contact with it.

Owing to incomplete knowledge of its life-history, this insect has been, I should say, misrepresented beyond measure. It is true that it has an extraordinary power of multiplication, but on the other hand it is of a slow and lazy habit.

The insect, living on the roots, has the power of generating without union of the sexes (*parthenogenesis*), and in Europe it has been ascertained that from six to eight generations occur during the year. In warm climates the number of generations is always higher than in cool or relatively cold ones; so that, judging only by induction, we have to believe that in New South Wales the insect finds the natural suitability of the weather favourable to its larger prolification.

The number of eggs laid by every insect is higher in the first generation, and steadily diminishes in the successive ones; and this is accounted for through a weakness of the genital apparatus, according to Mr. Balbiani, and to unfavourable conditions of feeding by Messrs. Franceschini, Iargioni, Iozzetti, and Lichtenstein.

In a vineyard the infected patches enlarge every year like an oil stain, owing to the emigration of the underground insects from roots to roots; but it is known that the interruption of rows, even of a few yards in width, may stop the march of the root-living form.

The winged phylloxera is commonly believed to be endowed with the greatest power of diffusion, and in the imagination of some people is regarded as a little "genius of evil," while really its short and heavy flight does not allow it to go very far. The wind might bring it from one district to another; but the barriers and bushes oppose very much the realisation of this danger.

Not all winged insects, fortunately, are fecund, a very great proportion of them being sterile. The number of the winter eggs which come from the copulation of the sexed insects born of the winged fecund is therefore less than it was first thought.

The winter egg marks the end of the life evolution of phylloxera; but it does not represent in the meantime the only way of reproduction of the insect from one year to another. It is a very well known fact that the root-living form of the last generation of that year is mostly responsible for the perpetuation of the insect, which, by falling into lethargy for some time in winter, revives next spring, and starts to lay eggs, so beginning the new series of *parthenogenetical* generations.

Those small infected patches surrounding a bigger one in a vineyard are accounted for by the winged insect, and by the removal of particles of the infected soil and of roots during the operations of cultivation with the plough and tools. When phylloxera outbreaks in a district rather far from an old infested place, the pest has been certainly brought through the thoughtlessness of the people. Rooted vines from condemned places are the most dangerous way of spreading the pest all about. Amateurs of viticulture are more guilty than the phylloxera itself in this regard. Their mania to grow new varieties of exotic name, no matter where from, is often the cause of importing the pest in clean districts. I remember a vineyard owned by a friend of mine, who, since the first infection was detected in his district, took the greatest care in disinfecting all labourers before allowing them to start to work in his place; he never omitted to do so for implements, machines, and tools coming from strange vineyards, and he was continually on the watch, so he succeeded in keeping his vineyard clean, while many of the vineyards of the neighbourhood were destroyed; but at last, after eight years, he discovered the pest in his, owing, of course, to uncontrollable causes.

I have seen in some places of the Continent in those vineyards where the rows of vines are some 30 feet distant, owing to the association of the vine with other cultures—maize, forage plants, &c.—for reasons of rural economy, where phylloxera progressed all along only one row without reaching the adjoining ones for three or four years.

Although the life history of the phylloxera is very variable from country to country, on account of the difference of the climate, and even in the same country and every year, owing to the manner of the season's progress, many peculiarities of this insect are now pretty well known; so that, possessing this increased knowledge of the enemy, we are at greater advantage in dealing with it.

The service of the inspections and destruction is organised in accordance with all the present knowledge of the plague, and vignerons are naturally expected not to destroy, through want of care, what is costing the community money—not to counteract the sound efforts of eradicating one of the worst enemies of the commonwealth. No pest attacking plants has committed such ravages as the phylloxera. To France alone, in about twenty years, it cost three times more than the unfortunate Franco-Prussian war, viz., £600,000,000, bringing desolation to many districts once flourishing, and alcoholism amidst a people famous for sobriety.

Those who look upon vine inspectors with niggling incredulity are acting against the good of the country—against themselves. They should morally help, by giving them all required information, and be on the watch so as to prevent any illicit commerce of rooted vines, so as to enable the officers to better fulfil their task.

In order to show our vignerons what precautions are taken, the rules issued by the Department for the guidance of the Inspectors are reproduced:—

Hints for the Inspection of Vineyards.

The number of vines to be inspected in a vineyard is left to the judgment of the Inspectors, and according to the greater or less probability of meeting with the pest. Their judgment may be founded on the neighbourhood of the vineyard to be inspected to an infested place; on the relationship between the owners of clean and infested vineyards, which may lead to the use of the same tools and machines. They will acquire information as to imported cuttings and rooted plants, or visits of labourers from condemned vineyards; and all similar valuable indications which may convey suspicion.

2. With the exception of the summary or bird's-eye view inspections, when one vine out of a certain number of vines is to be inspected, Inspectors shall adopt a plan so as to allow each vine to be looked at in the centre of a determined area.

3. The following are a few plans of intensive inspection:—

INSPECTION OF ONE VINE OUT OF TWO.

X	*	X	*	X	*	X	*	X	*	X
*	X	*	X	*	X	*	X	*	X	*
X	*	X	*	X	*	X	*	X	*	X
*	X	*	X	*	X	*	X	*	X	*

N.B.—Stars show the vines to be inspected, and X those not to be inspected.

INSPECTION OF ONE VINE OUT OF THREE.

X	X	*	X	X	*	X	X	*	X	X
X	*	X	X	*	X	X	*	X	X	*
*	X	X	*	X	X	*	X	X	*	X
X	X	*	X	X	*	X	X	*	X	X
X	*	X	X	*	X	X	*	X	X	*

INSPECTION OF ONE VINE OUT OF FOUR.

X	X	*	X	X	X	*	X	X	X	*
*	X	X	X	*	X	X	X	*	X	X
X	X	*	X	X	X	*	X	X	X	*
*	X	X	X	*	X	X	X	*	X	X

One vine in nine should be the limit of an intensive inspection; beyond this, the examination shall be considered as a summary one.

This plan is to be adopted in those places rather far from infested vineyards, or once infested.

ONE IN NINE.

*	X	X	X	X	X	X	X	X	*	X
X	X	X	*	X	X	X	X	X	X	X
X	X	X	X	X	X	*	X	X	X	X
*	X	X	X	X	X	X	X	X	*	X
X	X	X	*	X	X	X	X	X	X	X

N.B.—Stars show the vines to be inspected, and X those not to be inspected.

4. For bird's-eye view inspections Inspectors shall judge where to look at the roots on the appearance of a patch of vines not very healthy in the middle of a healthy vineyard; the vines showing cachexy, or chlorosis, short shoots, and either scarcely any crop or the want of ripeness at the normal time of vintage, the weakness of vegetation lasting two or three years without any exterior apparent cause, all these are reliable indications by which to choose the vines to inspect.

5. To get the roots the hole should be dug 4 or 5 inches off the stem, the Inspector to exercise great care that the labourer shall not do any harm to the vine or the crop in doing the work, and that the hole be filled in again properly after the inspected roots have been buried in.

6. Inspectors shall examine at least three roots of each vine at different depths to 10 inches, especially during hot months. Experience of past years has shown that in all the hot countries, during the hottest period of the season, it is sometimes hard to see phylloxera even in vineyards known to be infected. In such a climate this insect has not only the period of *hybernation* but also that of *æstivation*, so that it reaches unusual depth, living almost in a dormant state. Of course in suspicious cases Inspectors may examine as many vines as they think proper to be sure of the immunity of the vineyard. In sandy soil, roots deeper also than 10 inches shall be inspected, for in this kind of land phylloxera has been often detected at a depth of 2 feet.

7. Rootlets shall be preferred for inspection to roots of bigger size, and when they cannot be found, through being too deep or too scarce, as is sometimes the case in old vines in thick and dry soil, a small slice of bark shall be looked at.

8. Roots shall never be plucked up, but cut and carefully handled.

9. When, on account of the wet, the earth adheres to the roots, the Inspector should never pass them through the fingers to clean them, a little shake is enough; if they are still too muddy inspection should be carried out elsewhere for that day in vineyards planted in a looser soil.

10. While inspecting, roots are to be held by the two ends and turned slowly round, the eyes running from one end to the other.

11. When wind blows during inspection, Inspectors while examining roots shall turn their shoulders against the prevailing direction of the wind, and it is also suggested that Inspectors bend down. If inspection is carried on in a vineyard which by any reason is suspected of being infected, and the wind blows too strong, the work shall be interrupted, and Inspectors shall continue somewhere else where inspection can be made properly and without danger.

12. Before leaving an inspected vineyard, disinfection of shoes and brushing of clothes shall be done, either in case of the discovery of the pest or when the vineyard has resulted clean, because Inspectors might accidentally miss the insect, so becoming themselves unconscious conveyors of the plague.

13. Inspectors should therefore have continually within their reach a vessel with an emulsion of kerosene and soap ($\frac{1}{2}$ a gallon of kerosene and 1 lb. of common soap), a clothes brush, and a shoe brush. When it happens that infection is detected, and as soon as there is an interruption of infected vines, a proper disinfection with the said emulsion of the shoes and tools should be made on the spot before proceeding to examine further. When leaving the vineyard disinfection as above should be repeated.

14. For a proper disinfection of tools it is suggested, first to clean them of the soil, and this done to pass them for a few seconds through a flame, spreading on them the abovementioned emulsion with a sponge afterwards.

15. To disinfect boots, after having cleaned them of the soil, the above emulsion should be applied with a sponge on the leather, and especially on the sole and in the sewing. Inspectors should take care that all the labourers employed in an infected area perform this duty, because, as a rule, they are not willing to do so, either to spare trouble or for fear of spoiling their shoes (although the emulsion is quite harmless), or in the belief of these precautions being exaggerated.

16. Clothes should be brushed with a hard brush. Inspectors and labourers may help each other, but while doing so they shall put themselves alongside the fire, and in the direction the wind is blowing, so that all the dust may drop on the flames.

17. When the pest is met with, Inspectors shall again inspect the vines left behind, within a certain radius, on their judgment.

18. Weekly reports shall be written on a proper form; and in order to get a register which may lead to valuable information in the case of an Inspector sent to a district where inspections had been previously made, every acting Inspector shall keep in his own office a register report, transferable to the new officer who might be assigned to substitute him in that district.

19. When phylloxera is found in a vineyard, Inspectors should make inquiries and collect information leading to the source of that infection. As is said above, all tools used in an infected vineyard may convey the pest to a clean one; labourers through their shoes passing from one place to another, and cuttings, and especially rooted vines, are all artificial ways to which is due the spreading of the insect. The latest studies of the biology of phylloxera have shown that either the winged or the *radicicole* form is a natural way of diffusion not very considerable on clean vineyards if a little way off an infected area, and that this plague would not spread so much if vignerons were careful as to not importing tools and machinery, parts of vines, and not employing, or at least disinfecting, adventitious labourers coming from condemned places.

Rules for Destroying Infected Vineyards.

20. When the destruction of the condemned vineyard is approved of, this will be done as soon as possible. It shall be carried out by—

First, cutting off the part of vine above the ground and burning up with all stakes, &c., according to the Act now in force.

Secondly, by injecting a certain quantity of bi-sulphide of carbon in the infected soil.

Thirdly, by uprooting the vines, trenching the ground, and burning all roots that may be collected.

21. The above measures will form the so-called classic system of destruction but in special cases, the injection of bi-sulphide of carbon only may be considered sufficient, then a stronger proportion of the said insecticide should be applied.

22. The quantity of carbon bi-sulphide per square yard shall be from 150 to 280 grammes, according to the gravity of the infection, the quality of the soil, if more or less thick, or loose, and whether the ground shall be trenched or not.

23. The bi-sulphide may be used alone or mixed with kerosene or kerosene dregs, or other similar hydrocarbons when the quantity of the former at hand is not enough for the requirements.

24. Before starting any injection, if there are any cracks in the ground such as often occur in argillaceous soils during hot weather, they should be properly filled and closed so as to avoid any escape of the fumes of the insecticide.

25. Injections and trenching of the soil shall be continued for 6 feet beyond the last row of vines if any infected vine were found along that last row.

26. The insecticide shall be applied in three or four different injections, with an interval of not longer than three days. This will be for normal conditions

of moistness in the soil, and during the hottest months, but when temperature, owing to any cause whatever, lowers rapidly and the moistness of the ground augments at once, as it is after a heavy rain, the above interval of time shall be longer (4-5-6 days), and also injection may be suspended until the soil is again in a proper condition of moistness. These precautions must be maintained, especially for heavy thick soil, or else the insecticide would not spread through all the interstices of the ground, so lessening its destroying power.

27. A systematic plan of injections shall be adopted so as to distribute the insecticide as evenly as possible all through the soil, and it is desirable that the plan of injection be changed for each time.

The annexed plans are two illustrative instances. In the first the quantity of bi-sulphide of carbon to inject is supposed to be 157 grs. per square yard given in three times, say 62, 51, 44 grs. respectively; and in the second, 176 grs. represent the total quantity of the insecticide applied, in the proportion of 68, 54, 54 grs. given by turn each time.

28. All injections being completed, the stumps of vines already cut off should, if considered necessary, be split across and some 12 grammes of bi-sulphide of carbon, mixed with eight of kerosene dregs, or other good insecticide, poured into the split and all round the stump, so as to be more sure of the death of the plant.

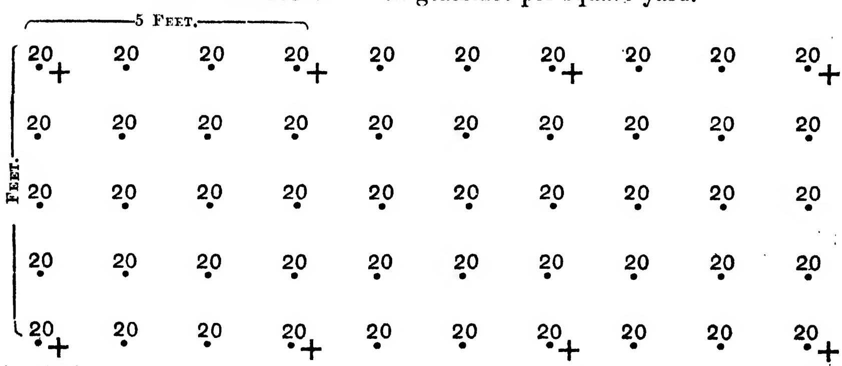
29. While trenching, if any root is found with live phylloxera on, the ground shall be compressed by means of rammers, and an additional injection of bi-sulphide applied on a certain area round the point of the discovery on judgment of the Inspector in charge of the service.

30. In all operations, whether inspecting, injecting, or trenching, Inspectors shall take care that they, and the labourers under their supervision, walk as little as possible on the infected soil and do not remove the dust, and also be careful to take all other precautions that they, being on the spot, may think proper to lessen the danger of spreading the insect.

FIRST INSTANCE.

PLAN of injection of 157 grammes per square yard, in three times.

FIRST INJECTION = 62 grammes per square yard.



N.B.—The black marks represent the holes where the bi-sulphide of carbon is injected; the crosses representing vines.

The quantities are given in grammes, because the injection pump is graduated with the metrical system of weight, each pressure forcing 10 grs. out. When a quantity less than 10 grs. is to be injected, a ring of leather on the top of the cylinder will reduce the quantity ejected by 1 gramme (about 14½ grains)

FIRST INSTANCE—*continued.*

SECOND INJECTION = 51 grs. per square yard.

+20	20	20	+20	20	20	+20	20	20	+20
20	10	10	20	10	10	20	10	10	20
20	20	20	20	20	20	20	20	20	20
20	10	10	20	10	10	20	10	10	20
+20	20	20	+20	20	20	+20	20	20	+20

THIRD INJECTION = 44 grs. per square yard.

+20	10	10	+20	10	10	+20	10	10	+20
10	20	10	10	20	10	10	20	10	10
20	10	20	20	10	20	20	10	20	20
10	20	10	10	20	10	10	20	10	10
+20	10	10	+20	10	10	+20	10	10	+20

SECOND INSTANCE.

FIRST INJECTION.

Plan of injection of 176 grs. per square yard, in three injections. 68 grs. per square yard in the first injection.

6 FEET.

8 FEET.

18+	18	18	18	18+	18	18	18	18+
18	18	18	18	18	18	18	18	
18	18	18	18	18	18	18	18	18
18	18	18	18	18	18	18	18	18
18	18	18	18	18	18	18	18	
18+	18	18	18	18+	18	18	18	18+

SECOND INSTANCE—*continued.*

SECOND INJECTION, showing position of the holes changed, = 54 grs. per square yard.

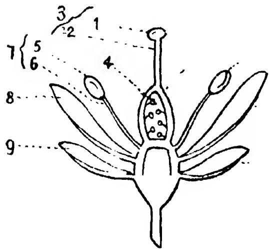
18 +	18	18	18	18 +	18	18	18	18 +
9	18	9	18	9	18	9	18	9
18	9	18	9	18	9	18	9	18
9	18	9	18	9	18	9	18	9
18	9	18	9	18	9	18	9	18
18 +	18	18	18	18 +	18	18	18	18 +

THIRD INJECTION—Showing again inverted the holes where the insecticide is injected.

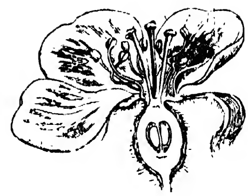
54 grs. per square yard.

18 +						18 +						18 +
		9	18	9				9	18	9		
	9				9		9				9	
18		9	18	9		18		9	18	9		18
9		18	9	18		9		18	9	18		9
18		9	18	9		18		9	18	9		18
	9				9		9				9	
		9	18	9				9	18	9		
18 +						18 +						18 +

By the exercise of these precautions, and the general adoption of resistant stocks, there is every reason to hope that our vineyards may be protected from the ravages of this dreaded pest.



I. 1, Stigma. 2, Style. 4, Ovary. 1, 2, and 4 combined form 3, Pistil, or the female portion of the flower. 5, Anther. 6, Filament. 5 and 6 combined form 7, Stamens, or the male p tion of the flower. 8, Corolla. 9, Calyx. 8 and 9 are the flo envelopes, and are for the protection of the Pistil and Stame In this diagram the ovary (4) is said to be *superior* that is, abo or within the parts 8 or 9. Whilst the blossom is in bud-form it is enveloped by the corolla and calyx, and cannot be seen until these parts are mature or fall.



II. The numbers, or parts, are the same as in Diagram I, but the ovary appears to occupy a different position. In such flowers the ovary is said to be *inferior*—that is, below or without the parts 8 and 9, and whilst the blossom is in bud is *not* enclosed by the floral envelopes. In the early stages of the development of the bud the ovary is always visible. I and II are bisexual or hermaphrodite flowers.

III. Maize.—A is the parts 5 and 6 or 7, the male or staminate flower shown in Diagram I; and B is the parts 1, 2, and 3, and forms the female or pistillate flower.

IV. The female flower of the melon. The undeveloped fruit or ovary is below the floral envelope, and for that reason is said to be inferior, and it is a unisexual flower.

V. The male flower of the melon.

[*We are indebted to Standard Botanical Works for these diagrams.*]

The Influence of Bees on Crops.

(Continued from page 266.)

ALBERT GALE.

It will be noted hereafter, the most essential parts of a flower are the stamens and pistil. These essential organs are most vigorous, healthy, and free from blemish in the earlier parts of the day. Just after the corolla bursts these unfurl, the anthers become distributive—*i.e.*, the pollen they contain is sufficiently mature to be wafted by the wind or gathered by insects or other agencies for fertilising purposes—and later the stigma becomes receptive. The atmosphere during these early hours, in spring time, as a rule, is characterised by a dead calmness, or at the most by gentle breezes. This calmness is most beneficial and is a highly necessary agent in ensuring successfully the fructification of entomophilous fruits. The more frequently the bees trip to and fro from home to orchard and orchard to home, the greater and better are the results that follow their labours.

I have used the terms bloom, flower, and blossom indiscriminately. They are synonymous. The two former are generally applied to the flowers on ornamental plants and the last to fruit trees.

To understand how the all-important work of fertilisation is carried on by bees and other insects, it will be necessary to glance over the accompanying diagrams and have a slight knowledge of the functions each portion of a bloom has to perform.

The pistil (3) Diagram I., is divided into ovary (4), style · (2), and stigma (1). The stigma is the end of the style turned inside out. It has four very peculiar characteristics: First, it is skinless; secondly, it is adhesive—if it be applied to down or a light feather it will adhere to it; thirdly, it is porous; and in the fourth place, it is covered with a lot of hair-like booklets. These peculiarities in the stigma form important parts in the economy of fertilisation taken in conjunction with the offices performed by bees in relation to fruit and the reproduction of plant life. The style is traversed internally by a canal forming a tube which is the connecting link between the stigma with the ovary.

The stamens are the masculine reproductive organs, and, like the pistil, different portions of it receive different terms—the anthers (5) and filaments (6). The filaments are thread-like appendages, and are generally attached to the base of the corolla, and not to the ovary, as in the case of the style; neither is it tubular. Their office is to support the anthers, and to keep them in their proper position. The anthers, generally two in number, are situated at the summit of each filament. They are of different forms, according to the class of fruit borne by the tree—round, angular, elongated, or sometimes twisted. When the blossom first opens, the anther is usually of a bright colour—generally yellow. Its upper surface is a flat, smooth disc.

As the day advances, and the anther matures, each one opens with a longitudinal slit its entire length. It can then be seen that each anther is a pocket or sac filled with pollen—a very fine dust-like flour. Pollen is of a variety of colours—white, red, pea-green, &c., are of frequent occurrence—but the predominating colour is some shade of orange. By watching at the entrance of a bee-hive, different bees will be seen to enter with pollen of various shades, although they prefer to work on those blooms that are yielding the greatest quantity. By taking a piece of honeycomb containing bee-bread, and cutting a cell filled with it longitudinally, strata of various colours are always to be seen. In flowers that are fertilised by insects, the pollen is usually of a sticky nature. This property is availed of by the bees. By this they knead it into small pellets, and neatly pack it in the pollen baskets on their hinder legs. The pollen of pumpkins and other members of that family, on account of its non-adhesive quality, they cannot so treat, but carry home in the hairs of their bodies. The pollen of blossoms fertilised by the wind is also non-adhesive. Pollen grains are of various forms, according to the class of plant it is taken from.

A casual observer might be excused for regarding the stigma and anther as similar organs of equal value in the economy of the flower. The dissimilarity between them is very marked and their functions wholly distinct. The anthers, as has been stated, are the pollen bearers. The stigma is the pollen receiver.

The corolla in many entomophilous plants is generally of an attractive colour. Its office is, while the flower is in bud, protective, guarding the developing essential organs from injury—acting as a blanket. Each portion of the corolla is a petal. There are generally three, four, or five petals in single blooms. Frequently they are united at the base, the tips only remaining free.

The calyx is the outer protective envelope. If the corolla acts as a blanket, then the calyx is the macintosh. Like the corolla, it is frequently formed of more than one part. Each separate portion is termed a sepal. It is generally green, but not always.

The beneficial influence of bees on certain crops, and the imperative necessity for their location within a near radius of fruit-trees, demands more than the usual passing glance. I say a *near* radius, because the nearer the home of this insect is to the orchard or fruit garden the more frequently can they visit the blossoming fruit-trees. The earlier in the day the bees visit the blooms the more certain will be the act of fructification and the resultant fertilisation the more effectual. Bees have been seen on their foraging ground beyond a radius of 3 miles. These long journeys must be undertaken at the expense of the number of trips made during the day.

Blossoms open at various hours, both in the day time and in the hours of night—the majority in the early morning just after sunrise, some at noon, others in the twilight, and a few varieties after dark. Some classes of blooms are very sensitive to light and darkness and will only open when the sun shines brightly. Those that open in the earlier portion of the day generally close towards sundown and reopen the following sunrise. Those that open at twilight and after it close at dawn. Evening and nocturnal opening flowers are visited by moths and other insects that are on the wing during the time between twilight and dawn. During a heavy flow of honey, bees will work for some time after sunset and well on towards darkness. On warm calm evenings the writer has more than once seen bees return home by the light of the moon when the latter has been shining brightly. Of course diurnal flowers are visited by diurnal insects.

Anemophilous flowers (those that are fertilised by the wind) do not close after they have once opened. The anthers being attached to the filament so tenderly, the slightest movement caused by a passing breeze is sufficient to shake the pollen to the stigma. It is the soft, gentle breeze that is efficacious in the fertilisation of cereal crops—wind just sufficiently strong to carry the pollen a few feet from the anther that produced it. At the time wheat and other cereal crops are in flower, when the pollen is mature and hanging loosely in the anthers, heavy wind storms are as destructive as late frosts. Many a crop that has appeared promising enough when in blade, has failed to give a heavy yield, owing to strong winds catching up the pollen and wafting it away in the bush, or elsewhere, where its influence is lost.

(*To be continued.*)

Poultry Foods.

J. J. McCUE,
Poultry Expert, H. A. College.

NEXT to proper accommodation and cleanliness, food is most important in poultry raising. To be successful in feeding poultry, we should know that however exact the knowledge of animal nutrition may become, and however thoroughly the practical poultry-keeper may be trained in his teachings, failure is sure to follow careless work and slovenly methods. A ration may be accurately balanced in all its parts with the potential energy suited to the season or climate, and the nutritive ratio properly adjusted for the work in hand; but irregular attention, undue exposure, vermin, cramped quarters, insufficient exercise, and many other causes, or any one of them, may undo all that the most skilful food compounder can devise. Science is but a help to good judgment. It goes all wrong when treated disrespectfully; but coupled with intelligence and energy, it produces results as regularly and surely as that night follows day.

With a thorough understanding of the principles involved, the poultry-raiser may avoid the waste of much valuable material in foods, as well as have more efficient control over his yard.

The value of a feeding material for the purpose of physical development is measured by the parts or substance in its composition which have been found by experiments to readily submit to the digestion process. These substances, or nutriments as they are generally termed, comprise parts of many classes of organic compounds. Mineral matter is also necessary, particularly with laying hens; but with the single exception of lime, these are all amply supplied in nearly all foods. The most important food-stuffs by far are the organic compounds, and these have been classified as nearly as practicable in accordance with the special utility involved. The nutrients are divided into three classes—protein, fat, and carbohydrates. These three divisions may, within certain limits, replace each other so far as animal energy or fat construction is considered; but for the formation of blood, muscle, tissue, and the most vital parts, protein is alone available. That these nutrients may be intelligently comprehended, it is necessary to treat them separately.

Protein includes all substances in the foods which contain nitrogen in combination, and in matured products is principally in the form known technically as albuminoids. Good illustrations are the white of an egg, the gluten in wheat, casein of milk, and the gelatinoids of bones.

Protein also includes such vegetable alkaloids as may be present, generally included under the term amides. They are not generally present in any very considerable quantities, except in green and immature fruits and grasses. In these the amides have been found to include as high as one half the total nitrogen, rendering the food of very doubtful value; but this is very rare,

and occurs in foods rarely or never used in poultry-feeding. The function of protein in the animal economy is to build up those portions having a similar composition, though it may be used as a source of heat and energy. It forms the tissues, the framework of the body, keeps in repair the muscle and bone, and supplies albuminoids for the blood, eggs, and digestive fluids. It is the most valuable component of foods, as it alone can do this special work, while the energy, heat, and fat may be derived from several other and cheaper sources.

Fats are utilised for fattening, heat, and energy. Common examples are tallow, lard, butter, corn, oils, &c. They vary considerably in nutritive value, the fat of green foods being of less value than that from matured seeds or their products. Fats form fatty tissue but not muscle. They are a form of concentrated food, and are established by nature as a reserve of heat and energy, laid up for the proverbial "rainy day." Carbohydrates includes sugar, starch, gums, &c., and are found in most grains and meal used for poultry food.

Fowls require a greater variety of food than any other of the domestic animals. Animal and green food are essential, although the bulk of the feed may be grain, either whole or ground. Any one having ever had the care of poultry, or an opportunity to observe their habits, must have noticed how quickly they will select the meat scraps first from a mixture of table scraps thrown to them; also when allowed to range, how eagerly they scratch and search for grubs, and jump and run after grasshoppers and other insects. Hens will also pick up a great quantity of grass and other seeds of plants in summer—still, not a sufficient quantity to keep the fowls in proper condition, or enable them to give profitable returns.

Feeding is an important item to the beginner. Many may think it simple, but it is nothing of the kind, for all food given means *cash*. Food may return more than its cost, or it may be wasted, giving no return whatever, or it may be so used as to be injurious. Another thing, cheap or damaged meal or grain is worthless; it would keep fowls from starving, still, we do not feed fowls and chickens to just keep them alive; we want substantial growth in the chickens, and vigorous egg-production in the hens. Hence, I believe in economy—economy in the truest sense of the word—to use the best wheat or pollard in the market, avoiding all damaged or semi-damaged meal or grain.

In nothing are poultry-keepers more culpable than in the manner they feed their fowls. The cleanest grains and mashes are thrown in the dirt and mud, oftentimes, so that the birds are compelled to eat a greater or lesser proportion of filth.

Because a fowl eats a large quantity of food, it is no reason for supposing such a matter of loss, or that it is unprofitable. The object should be to observe if the bird so appropriates the food eaten as to convert it into flesh or eggs. It requires a certain proportion of food to support the body, and only that over and above the use of the fowl for the support of waste is available for production.

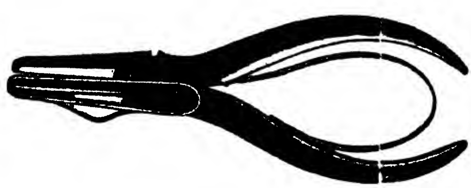
(*To be continued.*)

Orchard Notes for June.

G. WATERS,
Hawkesbury Agricultural College.

THIS is a busy month for all fruit-growers, the citrus fruit-grower, as he will or should be gathering the balance of the lemon crop, and the grower of summer fruits, because now he should be proceeding as quickly as possible with his pruning. If my suggestion of building some sort of storing-house has been followed by any, they will find the utility of it. Many growers I have heard remarking, "what is the best stage to cut lemons for storing." My reply would be as soon as they are large enough, or as may be the case this year after the severe stretch of dry weather, as soon as they commence to change colour, for in this stage they are perfect. Allowing them to remain longer only thickens the skin, and the juice deteriorates in quality.

The point that wants emphasizing is the absolute necessity for cutting, not pulling the fruit, as by this means the fruit is practically hermetically sealed. For this purpose a very handy implement can be procured in Sydney, similar to the following illustration, for which I am indebted to Mr. F. Coffee, of the *Australian Agriculturist*:—



The above is very greatly used in Florida and California for lemon and orange cutting, and has the additional advantage of holding the fruit after cutting, and so saves handling. If the fruit is not clipped it is useless to attempt to keep it for any length of time. The skin of the freshly-cut fruit contains a good deal of moisture which is liable to cause mould if the lemons are packed straight away. To get rid of this it is necessary that the fruit should be "sweated," and it is better to do this in the orchard, because it renders the skin tough; and therefore less liable to bruise when being carted. If the trees are any size, and are pruned low, it can be done by spreading clean straw beneath the tree on which the lemons are laid four or six deep. If the trees are not large enough, the fruit could be placed in boxes which are bored with a few small holes, so as to admit air, and allow them to stand on bricks or pieces of wood. Before being put in the curing or storing house (a method of building which appeared in last month's orchard notes), they should be carefully wiped and examined before placing on the trays to go into the house, and the house should be entered as seldom as possible. When the time arrives for packing (which should, and can be gauged by the market), they should be graded, wiped, and wrapped in paper.

More elaborate descriptions of dealing with lemon-curing have appeared in the *Gazette*, which should also be perused.

Following up the results of last year's shipment of oranges, large growers should be preparing for some shipments this year, for there is no doubt that if despatched at the right time, very large quantities can be absorbed in the home market. For this purpose towards the end of the month, oranges will be in good condition for picking for sweating before shipping.

In deciduous fruit orchards, pruning should be in full swing, not only because it is better done now, but by starting early, every tree receives its due attention, whereas if left late, the work is likely to be slummed; also after pruning, and the rubbish has been cleared off and burned, you can get the ploughing done, and also the very great essential spraying, If you are troubled with any insect or fungus pests, if you have not done so before, do some spraying this year, and the results will amply repay. The very best winter spray for deciduous trees is the lime, sulphur, and salt remedy, directions for making which, although given many times before, will not be out of place:—

"Take 40 lb. of unslaked lime, 20 lb. of sulphur, 15 lb. of salt, and 50 gallons of water.

"To mix, take 10 lb. of lime, 20 lb. of sulphur, and 20 gallons of water; boil for not less than one hour and a half, or until the sulphur is thoroughly dissolved, when the mixture will be of a light amber colour. Slack 30 lb. of lime in a barrel with hot water, and when thoroughly slacked, but still boiling, add the 15 lb. of salt; when this is dissolved the whole should be added to the lime and sulphur in the boiler, and the mixture boiled for half an hour longer, when water, to make the whole up to 50 gallons, should be added. Strain through a wire sieve, and keep well stirred whilst in use."

This mixture requires very careful mixing, and should be applied through a fairly coarse nozzle, and must be kept well mixed while being applied or the pump will choke. Care should be used that the mixture gets on the face or hands as little as possible, as it is very strong. For this reason the above spray should be applied while the trees are quite dormant. The value of this winter dressing is not appreciated, or else it would be much more used, as it would do away with a great deal of summer spraying. In fact, the winter washes are invaluable, for, the tree having no foliage, every part of the wood can be reached.

Deciduous fruit-trees should be planted during this month (except in the very coldest districts, where next month or August is better), as it gives them a chance to get good root-hold. A few maxims may not be out of place, viz., plant early; plant yearling trees where possible; plant carefully; do not plant too deeply; and in nearly every instance cut the tree hard back knee-high when planted, an exception to the latter rule being instances where the trees have been already pruned to the proper height in the nursery.

After pruning, the land should be ploughed and allowed to remain in a rough state in order to sweeten it, except where slowly-acting manures are to be applied, such as lime, bones, bone-dust, compost heaps, &c, which should be scattered broadcast, and either cultivated or lightly ploughed in. Even on land on which the cultivator has been used during the year, it is advisable to give this winter ploughing, as it breaks up the hard pan that almost invariably forms at the depth of cultivation. In the case of lime, it should be partially slacked before cultivating in, and should not be applied in conjunction with other manures. If not already done, attend to clearing out old drains or laying new ones where necessary. Money judiciously spent on drainage is well spent.

Practical Vegetable and Flower Growing.

Directions for the Month of June.

Vegetables.

Where vegetables cannot be planted or seed sown, on account of dryness, there is no reason why the ground should not be made ready for sowing or planting when rain falls, and the opportunity should be taken to clear away the remains of old vegetables and weeds.

Another useful work would be the collection of manure, which after being heaped up should be protected from drying winds if possible.

Artichoke-Globe.—Plant out suckers or rooted plants about 3 feet apart; but there is no hurry about this work, for any time will do until the spring.

Artichoke-Jerusalem.—This vegetable is quite unlike the globe artichoke, and has no relation to it whatever, not being an artichoke. It is grown from tubers, somewhat like potatoes, but with much rougher skins. There is but little difficulty in growing it in almost any kind of soil if well-rotted manure be applied, and the ground be well dug and drained.

Plant the tubers as soon as they can be obtained, for they are very apt to rot if kept out of the soil for any length of time. Plant in rows 3 feet apart, and drop the tubers 1 foot apart in trenches about 5 inches deep.

Beans, Kidney or French.—In very warm places where there is not likely to be frost, a few rows might be tried, but it is risky, as this vegetable is tender, and will not bear frost.

Beans, Broad.—This is a good time of the season to sow seeds where the soil is in good condition, and sufficiently moist. Carbonate of lime, superphosphate of lime, sulphate of lime, or bonedust are useful substances to add to farmyard manure for beans.

Cabbage.—Sow some seed to keep up a supply of plants. Plant out some good strong young cabbages to ground that has been heavily manured.

Endive.—Sow a little seed in warm parts of the Colony.

Carrot.—Sow a few rows of early shorthorn variety. Thin out former sowings, and keep free from weeds.

Leek.—Sow a good supply of seed in a seed-bed for transplanting purposes. Try London Flag and Musselburgh varieties. Plant out a few rows of well-grown young plants in trenches, which should be made about 18 inches apart. The leeks should stand about 9 inches apart. Plant deep in the soil after trimming back the roots. Make the soil very rich indeed with good farmyard manure.

Lettuce.—Sow a little seed in a seed-bed for future planting out. Plant a few rows of strong young lettuces in well-manured ground.

Onion.—Sow a little seed in drills, and look well after young onions which are coming on. Thin out when necessary, and keep free from weeds.

Parsnip.—Sow a little seed.

Peas.—Sow a good large supply in rows 3 feet apart. Make the drills about 3 inches deep, and drop the peas about 4 inches apart.

Radish.—Sow several varieties in small quantities.

Herbs.—Take up, divide, and replant old clumps.

Flowers.

During this month, if the season is favourable, the planting of deciduous plants may be carried out. Roses being general favourites should be planted largely, especially the tea and hybrid tea-scented varieties, for they bear flowers during nearly every month in the year.

Carnations of different kinds may be planted, especially those known as perpetual or tree carnations and marguerite.

Hardy annuals and perennials may be planted, but they will need some attention with respect to watering and shelter until they become established. Thin out any annuals that may be growing too close together in the garden, and those left will make better plants.

Do not plant out evergreens, such as camellias, until the beginning of spring. This work should have been done in the autumn, but it is very often delayed until winter, when a very large proportion of plants is lost.

Pull up old zinnea and other plants which are dead or dying off. Cut down the stems of chrysanthemums, and take up the clumps; divide and replant a small portion of each clump; or, if preferred, take up the clumps and replant in some out-of-the-way part of the garden for the present Then, later on, about August, take cuttings and propagate them for new plants. These should prove more satisfactory than the old stock.

General Notes.

Experiments in Pig Feeding.

A series of trials carried out in Denmark, extending over five years, with 893 pigs in all, separated into 175 lots, gave the following results:—

Whey for pigs has a higher feeding value, pound for pound, than turnips.

Indian corn and skim-milk make pigs grow fast and fat, but the pork is rather soft; therefore barley should be substituted for the corn when the pigs weigh 125 lb., and the quality of the flesh, if killed at 185 lb. weight, will be improved, and the shrinkage is no larger. Barley alone gave better results than when sunflower-seed oil cake was substituted for part of it. One pound of barley equalled, in pork-producing power, 6 lb. of skim-milk, or 12 lb. of whey.

Young pigs weighing 33 lb. to 75 lb., required 3¾ lb. of grain for its equivalent in milk or whey to make 1 lb. increase; at 150 lb. to 200 lb., about 5 lb. was needed, and old hogs weighing over 200 lb., consumed 6 lb. to 6½ lb. of grain for each pound of increase in weight. The animals ate but slightly more in winter than in summer, but it required nearly ½ lb. more grain feed for 1 lb. of gain in winter than in summer.

There was no marked difference between the food required per pound of gain on light and heavy feeding; nor was there any difference between the rate or cost of gain in barrows or sows.—*The Ulster Agriculturist.*

Saccharometers, &c., in Wine-making.

This paper formed a part of an unfinished essay on wine-making, written some twenty-five years ago. It came in under the heading "Determination of Density," and read as follows:—

For those who possess a balance of sufficient accuracy, there is, perhaps, no better method of determining either the density of a must, or the attenuation of a wine, than the balance and weighing bottle—for the practical wine student any instrument capable of weighing 1,000 grains to half a quarter of a grain is sufficient. It has, however, this drawback—it is essentially a laboratory appliance, and not portable.

The next instrument in order of accuracy is the "Bates' Saccharometer," used by officers of H.M. Customs. It is graduated in degrees of specific gravity, and its readings are intelligible to scientists of all nations. The instrument is accompanied by a book of tables and explanations.

The instrument most used in New South Wales is Keene's Hunter River Association's saccharometer. This is made of glass, and accurate enough for rough determinations. There are many other instruments for ascertaining density, which are now obtainable in Sydney.

The three instruments mentioned may be described as follows:—The balance is a very accurate pair of scales. The weighing-bottle a bulb of

glass, marked or stoppered to hold 1,000 grains of distilled water at a certain temperature. It is accompanied by a counterpoise, adjusted exactly to the weight of the bottle. When the bottle is full of the fluid to be tested, it is weighed, and the result in grains is its specific gravity. For instance, we will find that wine weighs some 994 and must 1080.

Bates' saccharometer is also graduated to specific gravity; but tables are published, showing the equivalent in sugar, salt, and most other substances likely to be treated. In use, this instrument is floated in the fluid, and the degree to which it sinks read off.

Keene's saccharometer also floats. It is, however, an instrument of less pretension than the others. Compared with the cost of Bate, £3 15s., it is inexpensive; but, being of blown glass, it must not be relied upon too much for density, although about zero (water) it is always correct. Therefore, in practice, during attenuation, as the critical point is approached, so does the error decrease. It is therefore a cheap and useful instrument as far as it goes.

In using the more delicate instruments for analyses or such purposes it is necessary to filter the specimen; but in the ordinary process of wine-making it is better to assimilate the conditions of the specimens to those of the bulk, which at best is only strained through a sieve or mosquito net.

P. F. ADAMS.

NOTE.—A superior instrument is obtainable at Flavelle's, in Sydney, price £1, and the ordinary one is sold at Lassetter's for 5s.

THE PACKING OF FRESH FRUIT.

"TOMAHAWK," writing from Tasmania, says:—"Mr. C. Gorman's instructions for packing fruit are excellent, but if that gentleman came in contact with Sydney dealers, as some of us do, he would just give the thing up in disgust. Here is my experience within the last week. For sending large pears, I had smooth half-bushel cases made to carry the fruit unbruised in one layer, after the French. Then I lined these cases, and wrapped each fruit in tissue-paper. In this way my fruit could be shown in the shop windows without the ugly bruises now so commonly seen. But this way did not suit the dealer, because he had always been accustomed to buy pears in a square, rough box, and the salesman sent me word that mine must in future be put in split-paling boxes, and no paper put round the fruit; and, he says, that my apples must be sent in the same way, and as it will be much less trouble, and cost less, I shall certainly send them that way, as the salesman has bought them, but I shall not put my brand upon them, neither will I be responsible if the fruit is spoilt in transit. I have talked to these dealers till I am sick of it. Now, Mr. Gorman has lectured us a bit, might I suggest that he tries his hand upon them.

I am writing from Tasmania, and would also suggest that, by Act of Parliament, your fruit-case should be made to hold some known quantity. I took some trouble to get our Act through Parliament, and it works capitally. When a buyer asks for a case of fruit, he knows what he will get, viz., the quantity which can be packed in 2,548 cubic inches of space, or equal to a fairly-heaped Imperial bushel. A short time ago I ordered a case of Sydney oranges. A flat box arrived, about 4½ inches thick, which held about ½ a bushel of fruit, and I was charged 5s. for it. Until I know what measure I shall get I do not intend to order another 'case' of Sydney oranges.

HOT WATER TREATMENT FOR SMUT.

IN a recent communication to the Department, Mr. W. Allan, of Dumaresque Island, Cundletown, Manning River, says:—

"A notable instance of the benefit of dressing grain with hot water for the prevention of smut occurred here. On the 3rd August, 1896, I sowed two bags of oats. I did intend to dress both bags with hot water, but owing to the team being ready to cover the seed before I had it dressed I sowed one bag without dressing. The other bag I dressed with hot water according to Dr. Jensen's process (see *Agricultural Gazette*, 1893, vol. 4, part 3). I obtained the seed oats from Sydney. The two bags appeared alike in every respect, and, I believe, had been grown in the same field. The two lots were sown on the same day, in the same field, with only a furrow dividing them.

"The piece on which the oats dressed with hot water was sown was perfectly free from smut, whilst the other piece was very badly affected, fully 15 per cent. of heads being smutty."

Replies to Correspondents.

Farmers should grow more Lucerne.

MR. THOS. WALL, of Woollomin, *via* Tamworth, remarks:—"Farmers should grow more lucerne. Put it up in well-made stacks, and it will keep for a long time, even, if not wanted, for three or four years. I have been in the Colony since 1867, and every six or eight years there is scarcity of grass—of late years more frequently—but many farmers do not appear to realise the necessity for preparing for a drought. They just go on from day to day."

The Department strongly endorses Mr. Wall's advice. Apart from the value of a good stack of this grand fodder as a stand-by for one's own stock, the commercial side of the matter is worthy of attention. For well-saved lucerne hay, in handy trusses, there is unlimited demand at really profitable rates. But it must be carefully saved, properly stacked, and honestly trussed. Carelessly saved, "raw" lucerne hay, or, more properly perhaps, "cabbage," can be marketed at a profit only when transport is a small item. An exhaustive article on the cultivation of lucerne for hay and pasture, as well as hay-making, appears in the "Farmers' and Fruit-growers' Guide," recently published by the Department.

Separated Milk for Calves.

MR. P. H. MORTON, M.P., of Shoalhaven, asks for information concerning the feeding of dairy cows' calves, now that milk is sent away and separated.

Mr. O'Callaghan reports:—"Calves do very well on separated milk, but it is extremely important that the milk be fed to them before it begins to go sour. The younger the calf the more necessity there is to do this. Linseed meal added to the separated milk makes up for the removal of the butter-fat, and calves cannot have a better food than this mixture. Factories should Pasteurise the separated milk, so that it would hold sweet thirty-six hours."

Pasteurising Cream.

MR. THOS. BLENCOME writes:—"I notice that butter made in my district does not keep well in a hot district like Sydney. Would sterilising or Pasteurising improve its keeping qualities?"

Mr. O'Callaghan reports that the Pasteurising of cream has a tendency to make butter keep longer than usual, but it is a difficult process to properly carry out, and would require some experience. He intends writing an article, which will appear at an early date in this *Gazette*, on Pasteurising cream for butter-making.

Oaten Hay as Winter Food for Dairy Cows.

Mr. Blencome also says:—"This district is suffering severely from drought, and rain will do us no good this season. Green crops are a failure. I saved some oaten hay, and I am thinking of buying bran to mix with it, chaffed and boiled in large boilers, and fed hot. Is this the best way to feed it?"

Mr. O'Callaghan states that crushed oats and bran will make an excellent winter food. Oaten hay is also very good. Feeding hot is a good system for cold climates, but in mild weather it will not pay to cook food for dairy cattle. If the oaten straw be chaffed, and a little chopped mangolds or pumpkins (if available) be mixed with it, the whole stirred up, and a little water (hot preferred) poured over the mixture, which may be allowed to stand twenty-four to forty-eight hours, a slight fermentation will set in, and the result will be an excellent fodder.

Grasses for Marshy Land.

Mr. James Armstrong, of Wapengo, asks for information as to grasses suitable for marshy lands. He has a dairy.

Mr. Valder, Manager, Wagga Wagga Farm, says there are many of our native grasses very suitable for growing on lands of the nature mentioned, but he does not know where seed can be procured, with the exception of *Panicum crus galli*, and sorghum halepense (Johnston grass), which are obtainable from the leading Sydney seedsmen. In the Macleay district the water couch, called locally "Seven Oakes," &c., does well, and is highly spoken of, but we do not know where seed can be obtained. Johnston grass should not be planted in any place that may be required for cultivation, as it takes complete possession of the soil. Water couch is also troublesome to eradicate.

Poultry.

Mr. W. Baker, of Martinsville, asks:—"What are the best pens to build for poultry? What should be the size of runs, and how many head should be kept in each pen? Would it be wise to let them all run together in an orchard of about 3 acres?"

The Poultry Expert, Mr. McCue, reports:—Poultry houses should be built on a dry site; if on level or low ground the floor should be raised by filling in earth, gravel, &c. A house 20 feet by 10 feet would hold twenty-five head, and if cleansed three times a week thirty to thirty-five head. Twenty-five head of poultry require a run of 25 feet x 50 feet, or half that if supplied with green food—cabbage, lettuce, &c. If the fowls are run in an orchard, less yard room round the houses will, of course, be required; but if different breeds are kept, each pen should be let out alternately. A good plan would be to run one pen in the orchard on Monday, No. 2 on Tuesday, and so on. By this system all the fowls could be allowed exercise, and the purity of the breeds maintained.

Sorrel.

Mr. Jackson Clarke, of Spring Creek Farm, Berridale, *via* Cooma, asks for information as to the best means of eradicating sorrel.

Mr. Valder, Manager, Wagga Wagga Farm, reports that the system he has always adopted is to tear the weed up with a cultivator or some such implement during the hot dry weather. He has often seen this method successful where sorrel has been very thick.

Dodder in Lucerne

MR. CLARKE also inquires how dodder may be got rid of. Full particulars of this parasite, with remedial treatment, have already appeared in the *Gazette*. In some cases, spraying with a fairly strong solution of sulphate of iron in water will destroy it; but the most effective way is to go over the paddock carefully, mow the infested patches, and burn the dodder on the ground.

Mr. Clarke's inquiry *re* the disposal of hares has been referred to the Board for Exports. Large numbers of hares are now being purchased and exported under the auspices of the Board.

Red Scale.

MR. THOS. EDWARDS, of Kingswood, asks for a remedy for red scale upon orange trees, as he has tried kerosene emulsion, and finds it does not kill all the scale. The Entomologist reports:—

A combined kerosene and resin emulsion, as follows, has been found to be very effective against red scale:—

8 lb. soft soap or soap-boilers refuse.
24 lb. best resin.
8 lb. sulphur.
4 gallons kerosene.
4 gallons water.

Boil the first three with the water until all are dissolved; then, while boiling, add the kerosene, with two quarts of boiling water to make up for loss in boiling. Boil up, but care must be taken not to let it catch fire. This makes 10 gallons. You can add 16 gallons of water to each gallon of emulsion, making 160 gallons to spray. The sulphur can be left out, but adds to its usefulness.

Care should be taken to clean the sprays after using all resin mixtures. It is worthy of mention that on a recent visit to the Murray Downs district Mr. Dunnicliff, of the Department, saw some orange and lemon trees that had been successfully cleared of red scale by means of a spraying of thin starch (boiled). Previous to this treatment the trees were very badly infested with scales.

Clearing Straw.

MR. R. HELSIE, of Leigh Farm, Cullinger, inquires: "What is the best way to clear land of straw? Most farmers burn of instead of raking off."

Mr. Valder, manager, Wagga Wagga Farm, says:—"If the straw can be cut and carted off it will pay. All the rough straw can be used for bedding to make manure, while the clean stuff can be pressed and sold. It is often worth while to stack good clean straw and put it on the market when prices are high. The demand is pretty steady. Farmers burn off their straw because it is the quickest way to get rid of it."

The Bot Fly.

MR. ALBERT EULENSTEIN, of Back Creek Farm, Henty, states that bot fly is very prevalent in his district in the spring and summer time, and several losses of horses have been ascribed to it; some with certainty. He asks for information concerning this insect, and how to cope with it. The Entomologist, Mr. W. W. Froggatt, has furnished the following particulars:—

"The bot fly (*Gasterophilus equi*) has been rather common in the Wagga Wagga district this last year.

"The fly deposits her eggs upon the hair of the horse, about the shoulders, mane, and fore legs. They are attached by a sticky substance, and the horse, licking himself, transfers them to his mouth, whence they make their way into the stomach. The maggots attach themselves to the coating of the stomach by means of two hooks, and remain until full grown, when they pass through the horse, fall to the ground, and change into a brown pupæ (the 3rd stage), from which the perfect flies emerge within a week or two.

Grooming the horses well and washing them with unpleasant smelling oils, soaps, &c., will keep the flies from depositing their eggs. It is also recommended to keep the horses in sheds or stables during the heat of the day, when the flies are most active, and do not, as a general rule, care about going into dark or shady places."

Cabbage and Turnip Pests.

MR. JAS. WHITBY, of Rocky Hall, asks for information as to the treatment for a small white fly, which is destructive to cabbage and turnips.

The Entomologist, Mr. W. W. Froggatt, says that if the small white "fly" referred to is the common cabbage moth (*Plutella cruciferarum*), already illustrated in the *Agricultural Gazette*, it is a matter of some difficulty to get rid of it. Paris green sprayed over them, in proportion of 1 lb. of Paris green to 100 gallons of water, will kill the small caterpillars better than anything else, and will not spoil the cabbages for market, but should not be done just before they are cut.

Powdered quicklime sprinkled over the leaves when the plants are smaller will kill many of the pests.

To destroy grasshoppers in gardens a mixture of arsenic, sugar, bran, and water, the proportions one part (by weight) of arsenic, one of sugar, and five of bran. Mix the bran and arsenic, then add the sugar dissolved in a little water. Place about a teaspoonful under a tree or plant infested. The insects will readily eat it and die. Care should be taken that no animals, fowls, &c., have access to the ground when this poison is distributed, and the remainder should be removed and brunt after the grasshoppers are cleared out.

Maggots destroying Peaches.

MR. J. H. ROSE, of Milgalarr, Warialda says:—"The peaches and nectarines in this district were almost all destroyed by maggots, which made their first appearance about two years ago, but have not troubled us seriously until this year. Followed instructions given for Codlin moth, and destroyed all windfalls."

The Entomologist, Mr. Froggatt, reports:—"These are probably attacked by the well-known 'fruit fly' (*Ceratitis capitata*, Wiedm). The fruit showing signs of attack should be picked off, and with all fallen fruit boiled, the rubbish round the trees turned over, and fowls or ducks given the run of the orchard, so that all the pupæ and larvæ that leave the apples would be destroyed before they could emerge as perfect flies. If the precaution of destroying all fallen fruit in orchards was more followed out, fruit-fly, codling moth, and other pests, would be soon diminished."

Manure for Vines.

MR. HENRY DREIS, of Fairfield, states:—"The subject of manures (for vines) is a very troubled one. Manures which have been recommended as showing good analysis have proved to be almost useless, especially in the

matter of bone-dust. It is almost impossible to get good bone-dust. The boiling-down establishments boil and steam the bones to such a degree as to make them almost useless as a manure."

The Chemist, Mr. F. B. Guthrie, reports:—"The application of bone-dust, however good, by itself to vines is not likely to be of much benefit. The manure required would be one containing potash and more available phosphate than bone-dust contains (see article in last issue). If the writer does not think his bone-meal up to standard of guarantee, he should send some to the Department for analysis."

Coloured Honey.

Mr. Geo. A. Reeve, of Gladstone, Macleay River, says:—"Lately the bees have been storing honey of a reddish colour, unlike any that bee-keepers here have seen before—honey that is said to be unsaleable. No one here seems to know from whence this honey was obtained. We should be glad to know. If you have not yet received a sample, I shall be happy to forward some."

The Department has not received a sample of this honey, but the following report by the Bee and Poultry Expert, Mr. J. J. McCue, may throw some light on the subject:—"I am of opinion that the bees stored honey from one of the tea-tree family, probably Bellbowrie (*Melaleuca leucadendron*), as I have extracted very dark honey from this source at times in the Port Macquarie district. If the bees stored any great quantity of this dark honey, it is nearly certain that it was gathered from whatever plant or plants was in bloom at the time—that is, the bloom that was in the majority. As a rule, it is possible to form a good idea of where the honey comes from if the blooms are observed. Buckwheat gives a dark honey, and so do one or two of the heaths of the north coast."

Exterminating Docks.

Mr. J. G. Pigott, of Inverell, mentions that in parts of the Hunter River districts which have become infested with docks through the agency of floods carrying the seed, the weed was effectually coped with by putting the land under lucerne, and preventing seeding of the docks by frequent sowing.

Humble Bees.

It will be remembered that some years ago the Department obtained from New Zealand a small consignment of humble (or bumble) bees, *Bombus hortorum*. Some of them were liberated at Richmond, and a few days ago Mr. Thompson, Principal of the Hawkesbury Agricultural College, saw several on the farm. Other officers, including the bee expert, have also observed these insects recently, so there is reason to suppose they are becoming well established.

Wheat for Black Mountain District.

Mr. James Hutton, of Black Mountain, asks for advice as to milling wheat suitable for his district, which is usually wet and liable to rust. Mr. Valder would recommend Australian Talavera, Berthoud, Marshall's Nos. 3 and 8 for general crop, and King's Jubilee, Steinwedel, and Allora Spring for quick-growing varieties.

Oats for Meal.

Mr. A. A. Cummins, of Quinburra, Bombala, asks:—

1. Can flour equal to wheaten flour be manufactured out of oats?
2. What kind of oats are used at present for making oatmeal or flaked oats, is there any market for same, and where is the seed procurable?

Society.	Secretary.	Date.
Murrumbidgee P. and A. Association (Wagga)...	P. W. Lorimer..	Sept. 1, 2
Burrawong P. and A. Association (Young) ...	C. Wright ...	1, 2
Albury and Border P., A., and H. Society ...	Geo. E. Mackay	8, 9
Murrumburrah P., A., and I. Association ...	Miles Murphy...	8, 9
Yass P. and A. Association	Thos. Bernard...	9, 10
Wallsend and Plattsburg A. H. P. P. and C. Society	G. Gilmour ...	9, 10, 11
Parkes P., A., and H. Association	H. S. Harwood..	15, 16
Junee P., A., and I. Association	T. C. Humphrys	15, 16
Burrowa P., A., and H. Association	J. H. Clifton ...	16, 17
Cowra P., A., and H. Association	Fred. King ...	22, 23
Temora P., A., H., and I. Association	W. H. Tubman.	22, 23
Narrandera P. and A. Association	J. F. Willans ...	Oct. 6, 7
Berry Agricultural Association	A. J. Colley ...	Nov. 25, 26

1898.

Dapto A. and H. Society	A. B. Chippendall	Jan. 12, 13
Albion Park A. and H. Association	H. Fryer ...	,, 19, 20
Kiama A. Association	J. Somerville ...	,, 25, 26
Wollongong A., H., and I. Association	J. A. Beatson ...	Feb. 2, 3
Robertson Agricultural Society	R. G. Ferguson..	,, 8, 9
Shoalhaven A. and H. Association	R. C. Leeming...	,, 10, 11
Tenterfield Intercolonial P., A., and M. Society	F. W. Hoskin...	Mar. 9, 10, 11
Inverell P. aud A. Association	I. McGregor ...	,, 10, 11, 12
Cumnock P. and A. Association	Thos. Howard...	,, 17
Camden A., H., and I. Society	W. R. Cowper...	,, 23, 24, 25
Bathurst A., H., and P. Association	W. G. Thompson	,, 23, 24, 25
Royal Agricultural Society of N.S.W.	F. Webster ...	April 6-12
Richmond River A., H., and P. Society (Casino)	Jas. T. Tandy...	,, 14, 15
Hawkesbury District Agricultural Association ...	C. S. Guest ...	May ——

Secretaries of Societies are asked to forward dates of forthcoming Shows as soon as decided.

[7 plates.]

Remarks on the Object and Method of Soil-Analysis.

F. B. GUTHRIE.

I SHOULD like to draw attention to a slight misapprehension that appears to exist in some quarters concerning the objects of soil-analysis and the methods adopted, and ask the indulgence of readers of the *Gazette* for a short discussion of the whole matter.

When a request is received for the analysis of a soil, the applicant is invariably asked in the first place to fill in a printed form.

This form contains certain questions, the answers to which will enable the individual who examines the soil to form some sort of idea as to its general nature and characteristics, its past history, and present surroundings.

Occasionally a correspondent resents this inquisitiveness, and recently one or two have pointed out that they do not wish to impart, but to obtain, information.

They would appear to look upon such inquiries in the light of riddles which the officers of the Department are invited to answer or incontinently "give up," any request on their part for further information being regarded as an attempt to wheedle the correct reply out of the questioner, and very properly resented by him.

This point of view appears to me to be due to a misunderstanding; and as I have reason to believe that this misunderstanding is shared by a large number of people besides those who have openly stated their view, I should like to examine the matter a little more closely. The whole thing arises from a mistaken conception of the object of soil-analysis.

This is not alone to chemically analyse the soil, but to examine it with the view of learning something of its peculiarities and capabilities so as to be able to suggest such treatment as will be most effective in producing the best results with certain crops.

Chemical analysis is only one of the means adopted towards this end.

It is undoubtedly one of the most important, but nothing is more certain than that a chemical analysis of a soil is *by itself* absolutely worthless. No known reagent that we can employ in the laboratory attacks the soil in exactly the same way that a crop attacks it; still less can we reproduce the action of a variety of crops.

Further, there is in most cases little reason to expect that the soil has been sampled with any care. True, the objectionable "form" contains explicit directions on this head, but probably those who resent the document do not take much trouble to comply with its requests.

Granted that all care is taken in the sampling, it must not be overlooked that even if the soil were fairly uniform, there are other accidental circumstances which would still make it uncertain whether the sample selected was representative; for instance, a tree might have grown and decayed on the particular spot from which the sample was taken; an animal or a bird might have passed over it and left its droppings. These would all affect the composition of the surface soil, seeing how small the quantities of the fertilising ingredients are.

But even if we assume that these difficulties are overcome, that we have sampled our soil in a satisfactory manner, and that the reagent we employ represents fairly the action of most crops, we should still be unable to say what would probably be the best method of treatment for different crops in order to obtain the best results. We should be rash if we based even a general opinion as to its fertility or otherwise upon a chemical examination alone.

A soil may be rich in plant-food, and only a few inches deep; another may be somewhat poorer, but several feet deep. In this case it is more than likely that the poorer soil would be more fertile.

The subsoil may be of such a nature that it requires draining; the climate may be such as to render the production of crops, for which, "chemically," the soil is suitable, impossible.

The same is true of the aspect of the land, its proximity to the sea, &c., &c.

No information on any of these essential points is afforded by examining a few ounces of soil dumped down in front of one without a word. It is just this information that is asked for.

Of course, there are yet other data requisite for correctly estimating the capabilities of a soil. In addition to the purely chemical examination, the soil is always further examined as to its physical nature—the proportion of sand, clay humus, &c.—its absolute weight, the amount of moisture, its capillary power, its capacity for absorbing water, &c. These latter determinations, which depend largely upon the texture and porosity of the soil, are of even more importance than the content of plant-food, because on them depends the question whether the plant-food present can be readily utilised or not. The characteristic which, in my opinion, is the most important of all as an indication of fertility—the power of nitrification and of the reproduction of soil bacteria—we have not hitherto been in a position to determine, and have been obliged to assume it from general considerations, such as texture, porosity, &c.

I hope, however, before very long that the requisite accommodation and assistance will be provided, and we shall then be able to speak positively as to the nitrifying power of any given soil, and pronounce definitely whether it is a fertile one or the reverse.

The foregoing outline sketch of the methods adopted in soil analysis are sufficient to show that in order to arrive at an understanding of the requirements of a soil it is essential to know, in the first place, its chemical nature; in the second, its physical structure and texture; and thirdly, something of its history and environment.

The first two data can be obtained with more or less accuracy in the laboratory, but the equally important information concerning its surroundings can only be supplied by the sender, and it does not appear unreasonable to ask him to furnish such data as he is in possession of.

The more information he can give the more reliable will be the suggestions contained in the report.

It may occasionally happen that a correspondent says he does not require an opinion as to the capabilities of his soil, or advice as to its treatment. He simply wants to know the amount of plant-food present, in order to supply what is deficient by means of fertilisers.

I wish to warn those who still regard the matter in this light that such a course is not likely to be productive of much benefit. The object of manuring is not to enrich the land, but to supply food to the growing crop; and the nature and amount of the fertilisers to be added should be governed by the nature and requirements of the crop.

In other words, manure the crop and not the soil.

I should not have dealt with the foregoing matter at such length had it not been for the fact that I am afraid the objection to imparting information to the Department is not confined to the particular case in question, namely, the filling up of soil-analysis forms, but is of wider existence. For instance, together with every soil report, a note is printed asking the recipient to communicate with the Department the results he obtains by following the suggestions made in the report. In no single instance has this request been complied with—at least no instance has ever come under my knowledge; and yet the information would be of the utmost value to me, and I venture to think also to future applicants for information, for I should be able to modify future reports in the light of such information. With regard to the general question of the propriety of imparting information to the Department, it seems to me that the objections to doing so are based upon a rather narrow view of its functions.

The Department of Agriculture possesses admirable facilities for circulating information amongst the farmers. The only use made of information received, or which it is possible to make, is to impart it to others.

Much more advantage might be taken of this fact than is at present done. If a number of those interested in farming were to found social clubs or Farmers' Unions in the different districts, where they could meet periodically and discuss topics of common interest, it would be found that a number of questions could be referred with advantage to the Department, and the answers communicated in this way to a larger number than is now the case.

The establishment of such Farmers' Unions, which is carried out extensively in Tasmania and South Australia, with excellent results, would keep farmers in touch with each other and the Department to the mutual advantage of all.

Chemical Notes.

F. B. GUTHRIE.

Sugar Beets.

THE following gives the sugar contents of the juice of a number of sugar-beets grown in the Berrima district, and which competed for prizes offered by the Berrima Agricultural and Horticultural Society. The figures show the percentage of cane-sugar in the juice by volume. These figures would not be quite so high if the calculation was made to percentage of sugar in the root itself by weight. As the beets are not to be sent to the sugar-mill, this information is not essential, and I have given the higher figures.

Nevertheless, the percentage, especially in the first few samples, is extraordinarily high; in fact, by far the highest yet obtained in beets grown by farmers which have been hitherto examined by the Department. This is no doubt due partly to the dry and hot season, and against it is to be set the fact that the amount of juice yielded by the beets is rather below the average. Partly, also, it is undoubtedly due to the greater care which has been devoted to the cultivation. Each analysis is the average of twelve samples. The varieties of beet were not stated, but the results go to show that the district is eminently suited to this crop.

It will be noticed that the small beets nearly always show the higher sugar content, though one sample of enormous roots comes exceptionally high in the list. The size to grow for the mill is between 1 lb. and 2 lb.

SUGAR BEETS from Berrima Agricultural and Horticultural Society.

	Average weight of 12 roots.		Percentage of cane sugar in juice (average of 12 samples).
	lb.	oz.	
1	0	8½	25·3
2	0	8	24·5
3	0	7⅔	22·5
4	0	15¼	22·5
5	0	13¼	21·0
6	1	9¾	20·5
7	0	7⅔	20·5
8	3	4¼	18·0
9	1	2⅔	17·8
10	1	2	17·2
11	0	11⅔	16·8
12	2	2	16·8
13	1	14½	16·7
14	0	14¾	16·0
15	1	2½	14·5
16	1	10½	14·2
17	0	14	14·0
18	1	15½	13·2

Lime.

The majority of the soils sent in for analysis require liming, if the best results are to be obtained. This is more particularly true of the soils in the neighbourhood of Sydney—of the counties of Cumberland and Camden. Manure agents, however, do not, as a rule, deal in this substance to any

extent, and for this reason I think it might be of interest to give an analysis of the different varieties of lime which can be obtained from the Cullen Bullen Lime Co., Sussex-street. They are as follows:—

1. QUICKLIME or STONE LIME, containing 93 per cent. calcium oxide. Sold at £1 13s. per ton in Sydney.

2. AGRICULTURAL LIME. Sold at 16s. per ton in Sydney.

Calcium oxide	75·45
Carbonic acid	2·88
Insoluble	17·34
Magnesium oxide	·60
Moisture and combined water	·89
	97·16

3. GROUND LIMESTONE—48·96 per cent. calcium oxide. Equivalent to 87·44 per cent. calcium carbonate.

Of these three the two first are the products most required by the farmer, and they are both of excellent quality. Which is to be used in different circumstances, is more fully discussed in the *Farmers' and Fruitgrowers' Guide*, pages 44, 45, and 46. As a rule the stone lime is to be preferred, as its action is far more rapid and energetic. The stone lime is placed in small heaps about the field, and allowed to slake quietly by exposure to air for a day or so. In very dry weather it should be slightly sprinkled with water. It will then quietly crumble to a fine white powder, which is mixed with loam and distributed evenly over the field and very lightly harrowed in.

Liming is best performed in autumn or winter, or when the ground is not under crop, and it is safest to allow two or three weeks to elapse before sowing or adding manure.

The following partial analysis of a sample of limestone rock from Wingham, Manning River, may be of interest in this connection.

Insoluble and silicates	2·84
Oxides of iron and alumina	1·24
Calcium carbonate	84·05

Manures obtainable at the Young and Districts Chilled Meat and Produce Storage, Young.

The following fertilizers, which are obtainable at the above address, were unfortunately forwarded too late to enable the analysis to be incorporated in the list of fertilizers published in the May *Gazette*.

The analyses are, therefore, given here.

1. CRUSHED BONE AND MEAT.

Moisture	5·83
*Volatile and organic	65·51
Insoluble	2·26
†Tri-calcic phosphate	20·44
Other lime-salts, calculated as carbonate	5·05
	99·09

*Containing nitrogen	7·01
Equivalent to ammonia	8·51
†Equivalent to phosphoric acid (P_2O_5)	9·36

2. BLOOD MANURE.

Moisture	9·20
*Volatile and organic	84·29
Insoluble	·13

*Containing nitrogen	= 10·94
Equivalent to ammonia	= 13·28

Nipho.

What appears likely to prove an excellent nitrogenous manure, at a reasonable price, is prepared from the refuse soup from boiling-down works, and is for sale under the above name. The product is in the form of a fine powder, and can be at once applied in the same way as dried blood, either by itself or mixed with phosphates and potash.

Nipho is a purely nitrogenous manure, as the following analysis will show:—

Moisture	7·48
Volatile and organic (containing nitrogen 12·58, equivalent to ammonia 15·28)	81·48
Mineral matter	11·04
	100·00

The mineral matter contains:—

Insoluble matter	·20
Lime salts (as $Ca\ CO_3$)	7·73
Phosphate of lime	1·03
Potash (K_2O)	·64

The above are the only ingredients that affect the value of the manure.

The product is practically gelatine dried in such a way as to crumble to powder instead of hardening.

It contains about the same percentage of nitrogen as commercial dried blood, and I believe it is safe to say that it is more readily decomposed in the soil, and thus more readily available.

It dissolves very readily in cold water, 77 per cent. being soluble in water, and in this form should be still more easy of decomposition, and should be not far inferior in rapidity of action to ammonium salts or nitrate of soda.

It should be an excellent substitute for dried blood, and form a valuable manure for cereals, grass, &c., when mixed with superphosphate.

By the addition of superphosphate and potash in the proper proportions it would make a good, general, quick-acting manure, suitable for orchards, vines, root-crops, &c., &c.

Orange Wine.

The following analysis of a sample of orange wine prepared locally may be of interest:—

Specific gravity of distillate at 15·5° C.	982·71
Specific gravity of de-alcoholised wine at 15·5° C.	1,090·44
Alcohol by weight in volume	13·44
Percentage of proof spirit	24·05
Total acidity (tartaric acid)	·69
Total extract	23·50

The extract is chiefly added sugar.

Dog Biscuit.

The following analysis shows the composition of a brand of dog biscuit manufactured locally.

It will be seen that the nutrient value is high—about 86—the proportion of fat and albuminoids being especially good.

They should prove an easily digestible and nourishing food for the purpose intended.

Moisture	7·71
Fat	9·42
Albuminoids	27·31
Carbohydrates	45·47
Crude fibre	3·12
Ash	6·97

Report of an Investigation into the effects of Darling Pea (*Swainsona galegifolia*) upon Sheep.

CHARLES J. MARTIN, M.B., D.Sc.
Acting Professor of Physiology, Melbourne University.

THE following report is largely founded upon personal observations made upon twenty-three sheep supposed to be suffering from the effects of eating Darling pea. After I had observed the symptoms manifested by the animals they were killed, and careful *post-mortem* examinations were made, including a microscopical examination of all the organs.

In addition to the above, healthy sheep were fed exclusively upon Darling pea for upwards of four months.* The experiments were conducted under conditions excluding, as far as possible, any source of fallacy. By feeding upon the plant, all the symptoms and pathological changes which I had observed in sheep taken from the paddocks were reproduced.

Such being the case, it will be simpler if I confine my report to a statement of,—

(1.) The conditions under which the experiments were carried out.
(2.) A description of the symptoms which followed feeding upon the "pea," and the conclusions to be drawn from the experiments.
(3.) The pathological changes produced in sheep by Darling pea when eaten continuously in large quantities.

(1.) Conditions under which the Experiments were carried out.

Ten sheep, aged 2 years, in fine condition, were chosen from a flock which had been in a paddock where the pea is almost absent.

They were first numbered for identification, and divided into two lots of four and six. Each lot was placed in a separate pen, in a sheltered position. Both lots were supplied daily with salt, and fresh water. The sheep in the pen containing four were fed exclusively upon lucerne; those in the other pen exclusively upon Darling pea. In addition, two other sheep ("pea-eaters"), already showing symptoms attributed to Darling pea were included with the six sheep, and also fed exclusively upon the "pea." The Darling pea was gathered fresh every day and supplied to the sheep morning and evening. At the time the experiment began it was young and succulent, and in flower. Towards the end of the experiment it became tougher, and with more seed-pods. The only variation in the condition to which the two pens of sheep were subjected was as regards diet.

The sheep fed upon lucerne were kept in the pen for purposes of control, and in order that I could the more easily detect any slight differences in

*Specimens of the Darling pea on which these sheep were fed were examined for me by my friend Mr. Maiden, Director of the Botanical Gardens, Sydney, as *Swainsona galegifolia*, R. Br.

behaviour which might follow feeding upon the "pea." Every sheep was weighed once a week, and the weight, together with observations made during the week upon any particular animal, entered in a note-book kept for the purpose.

2. Description of the Symptoms following feeding upon the Darling Pea.

The experiment was begun on the 15th August, 1896. The four sheep (Nos. 1 to 4) fed upon lucerne lost during the first fortnight a few pounds (5 lb. to 10 lb.) in weight, but ultimately recovered this amount. They fed well, and continued in perfect health until 30th September, when they were let out.

The following are the details of the experimental results of an exclusive diet of Darling-pea :—

Sheep No. 5 ; 2 years old.

Aug.	15...	Weight, 51 lb.	... Experiment began.
,,	22...	46	... Eat little or nothing during week.
,,	29...	36	... ,, ,,
Sept.	5...	39	... Eat well during week.
,,	12...	45	... Eat well during week ; urine drawn by catheter, and examined ; normal.
,,	19...	42	... Eat well during week ; urine drawn by catheter, and examined ; normal.
,,	26...	45	... Eat well ; stupid looking ; slight awkwardness in gait.
Oct.	15...	39	... All symptoms increasing ; trembles ; urine containsalbumen.
,,	31...	35	... Very often falls over, and cannot always get up again alone.
Nov.	30...	27	... Terribly emaciated, as it cannot stand to eat ; when put on its legs trembles, and when walks hind legs appear to give way ; killed.

Post-mortem Examination.—Organs all apparently healthy. Microscopical examination of the brain and spinal cord revealed no anatomical change.

Sheep No. 6 ; 2 years old.

Aug.	15...	Weight, 56 lb.	... Experiment began.
,,	22...	41	... Eat no food first week.
,,	29...	37	... Eat little food second week.
Sept.	5...	40	... Eats pea ravenously.
,,	12...	40	... ,, ,,
,,	19...	38	... Eats well ; expression become agonised and dull ; slight stiffness of gait.
,,	26...	35	... Symptoms increased.
Oct.	3 ..	37	... Gait clumsy ; skin very white.
,,	10...	35	... ,, ,,
,,	17..	31	... Condition same.
,,	24...	33	... Frequently falls about.
,,	31...	29	Eat well ; became progressively weaker, and more unsteady on legs ; frequently unable to get up again when down.
Nov.	7...	31	
,,	14...	28	
,,	21...	29	
,,	28...	33	
Dec.	5...	29	
,,	10...	...	... Escaped during night, and drowned itself in the creek.

Sheep No. 7 ; 2 years.

Aug.	5...	Weight, 57 lb.	... Experiment began.
,,	22...	47	... Eat very little during first week.
,,	29...	38	... Eat very little second week.
,,	5...	39	... Eat fairly during third week.
,,	12...	41	... Expression dull.
,,	19...	42	... ,,

Aug.	26...	Weight, 42 lb.	... Expression dull; slight stiffness of gait.
,,	3...	40	.. Gait becoming more clumsy.
,,	10...	37	... Condition same.
,,	17...	39	... ,,
,,	24...	39	... Beginning to fall down sometimes; trembling.
,,	31...	35	... Very unsteady; often falls.
,,	7...	35	Became progressively weaker and more unsteady on limbs.
,,	14...	32	
,,	21...	30	
,,	28...	31	
,,	5..	30	
,,	10...	...	... Escaped, and drowned itself in creek.

Sheep No. 8; aged 2 years.

Aug.	15...	Weight, 61 lb.	... Experiment began.
,,	22...	50	.. Would not eat pea.
,,	29...	41	... ,, ,,
,,	5...	53	... Fed on lucerne, and experiment discontinued.

Sheep No. 9; aged 2 years.

Aug.	15..	Weight, 61 lb.	... Experiment began.
,,	22...	60	... Eat pea well.
,,	29..	50	... Eats less.
Sept.	5...	52	.. Eats fairly well; urine normal.
,,	12..	51	... No symptoms obvious.
,,	19...	48	.. Expression markedly duller.
,,	26..	50	.. Expression markedly duller. No other symptoms.
,,	30...	....	Put in paddock free from "pea." Two months later this sheep was in "first-class order."

Sheep No. 10; aged 2 years.

Aug.	15..	Weight, 58 lb.	... Experiment began.
,,	22...	63	.. Eat "pea" well from beginning.
,,	29...	48	... ,, ,,
Sept.	5...	51	... ,, ,,
,,	12...	48	... ,, ,,
,,	19..	46	... Sleepy looking.
,,	26..	26	.. Shaking; slight stiffness of gait.
,,	30...	....	Put in paddock free from pea. Two months later this sheep was in fine condition, and free from all symptoms.

Sheep No. 11.—"Pea-eater," aged 3 years; ewe; appearance stupid, and suffering from slight awkwardness in gait, and trembling of head.

Aug.	15..	Weight, 48 lb.	... Experiment began.
,,	22...	45	... Feeding well.
,,	29..	40	... Feeding well; awkwardness of gait increasing.
Sept.	6...	45	... ,, ,, ,, hind legs give way every now and then.
,,	12...	45	... Feeding well; urine drawn by catheter; normal. Becomes very clumsy; tumbles when made to run.
,,	19...	40	... Feeding well; symptoms increasing, especially trembling.
,,	26...	45	... Feeding well.
Oct.	3...	46	... Feeding well; never lies down; when falls down cannot get up again by itself.
,,	10...	45	... Condition same.
,,	17...	46	... Head continually working up and down; eats ravenously while standing, which it can do for a few minutes only, when it tumbles over backwards and struggles violently.
,,	22...	43	... Has not eaten anything for three days; cannot stand up; lies upon its side, making occasional efforts to get up; killed; organs examined microscopically.

SHEEP No. 12.—"Pea-eater," aged 2 years; in poor condition; very jerky in its movement.

Aug.	15...	Weight, 42 lb....	Experiment began.
,,	22...	40 ...	Eats well.
,,	29...	39 ...	,,
Sept.	5...	42 ...	,,
,,	12...	41 ...	,,
,,	19...	40 ...	,,
,,	26...	44 ...	Eats well; symptoms not increased; urine drawn by catheter; normal.
,,	30...		

Let out into paddock free from pea. Two months later this sheep was in just the same condition.

From the above quoted experiments it is seen—

1. That one can by feeding sheep upon Darling pea reproduce all the symptoms which are attributed by pastoralists to this cause. Briefly stated these symptoms are:—Stupidity, loss of alertness, and an agonised expression, followed by stiffness, and slight staggering, and frequently trembling of the head or limbs. Later, clumsiness and unsteadiness ensue, which slowly advance until the animal often falls down. In this stage, the action of the animal in running over small obstacles is characteristic. It jumps over a twig as if it were a foot in height. When first it commences to tumble about, it is able more or less readily to regain its feet, but in the advanced stage of the disease this is impossible, and after exhausting itself in efforts to do so, it remains lying down until it dies. During the whole time, the sheep becomes progressively more bloodless, and in advanced cases the blood when shed appears to the naked eye lighter in colour. It contains fewer red blood-cells (about two-thirds to one-half the usual number.)* All these symptoms are much exaggerated by driving. Thus, an animal in which the symptoms are little marked, may exhibit them in a striking degree after being driven. In addition to the above, the teeth (especially in young sheep) frequently become loose, and consequently displaced or even dislodged.
2. That the time which elapses before the onset of definite symptoms is three to four weeks in sheep of 2 to 3 years old. (It is probable, however, that with younger animals the time is shorter.)
3. That under the conditions of the experiment, the animals survived about three months. They lived, however, an invalid's life. Everything was brought to them, and it is improbable that if feeding exclusively upon pea, and left to shift for themselves in the paddocks, they would survive more than two months.
4. That if a sheep be returned to proper fodder after one month to six weeks feeding upon pea, and before the symptoms are fully established, it may recover completely.
5. That when once the paralytic symptoms are established, it will not recover; but if returned to proper food, will remain in much the same condition, becoming neither better nor worse.
6. That Darling-pea contains a very fair amount of nourishing material, so that animals may, provided they eat it readily, retain their condition on it for some weeks, until the poisonous principle contained has had time to exert its effects.

* The corpuscles were estimated in several cases by means of a hæmocytometer.

The changes produced in the bodies of Animals by feeding upon Darling Pea. (Pathology of the Disease.)

Before making my preliminary report upon the effects of Darling pea, I satisfied myself that the animals were not suffering from any known disease. The only evidence of any altered condition of the organs which I discovered at that time was that the kidneys of the lambs which I examined showed, when observed under the microscope, signs of chronic inflammation. Since writing that preliminary report, I have had opportunities of making a much more extensive series of *post-mortem* examinations upon sheep of all ages, and I find this affection of the kidneys to be much less general than I had been led to suppose. The only explanation I can offer is that the animals at first examined were much younger, and had exhibited this effect more than older ones. I have since observed the same affection of the kidneys in older animals suffering from extreme symptoms, viz., in two sheep and one bullock, and in these three cases the urine before death contained some albumen. I am, however, convinced that this affection of the kidneys is not a necessary nor an important symptom of the disease. In all the *post-mortem* examinations I have made, in no case have I been able to detect anything amiss with any of the organs to the naked eye. The animals were mostly emaciated, although they still possessed fat, and the wasting appeared to be principally in their flesh.

In five cases I have made a complete microscopical examination of all the organs, and in every case they were (with the exception of the kidneys abovementioned) not unhealthy. This microscopical examination of the organs included the brain and spinal cord of three sheep which exhibited the symptoms in an extreme degree. These were in each case absolutely normal in appearance, and showed no degeneration of nerve fibres nor nerve cells.*

The nature of the symptoms indicated a disordered condition of some part of the brain, spinal cord, or peripheral nerves. Finding nothing in the central nervous system, I next examined the nerves. The nerves of the limbs of two badly affected sheep were carefully dissected out down to their ultimate termination in muscles and skin. Samples of these nerves were cut up, stretched upon sticks, and hardened in bichromate of potassium. From these pieces sections were cut, and stained both with nuclear stains and by Pal's method.

An examination of the distal pieces of the nerves displayed the cause of the symptoms. The disease is confined to an affection of the nerves which exists only near their terminations, either in the skin or muscles.

The affection consists of a degeneration of the essential part of the nerve-fibres, and corresponds to what is known to pathologists as peripheral neuritis. This degeneration was not discoverable to the naked eye.

The degeneration is confined to within a very short distance from the peripheral termination of the nerves. Nerve bundles, containing about twenty-five or thirty nerve-fibres, may exhibit almost total degeneration; whereas the same fibres, traced up nearer their origin from the spinal cord, and where they are enclosed in bundles of large numbers, appeared quite normal. Serial sections were cut after embedding in paraffin or celloidin so that the same fibres could be traced for upwards of an inch. From observations

* Note.—The organs were hardened in spirit or solutions of chromic salts, and sections cut, and stained with ordinary nuclear stains. The brain and cord were hardened in solutions of chromate of potassium. Sections were cut from pieces at short intervals, stained by Pal's method, and also with aniline blue-black, and examined. Neither method displayed any interference with nerve paths or degeneration of nerve cells.

made in the above way, the degeneration was found to be confined to the peripheral half-inch of the nerves. The larger bundles merely showed a few nerve-fibres to be missing. The best way to demonstrate the degenerated fibres was to cut sections transverse to the course of the nerve-fibres, of the connective tissue just distally to the point where one ceased to be able to dissect out the finest branches of the nerves. The nerves in this connective tissue consisted of bundles of from ·1 mm. ($\frac{1}{250}$ inch) in diameter downwards.* In the bundles of ·1 mm. diameter a few of the nerve-fibres had degenerated. Those measuring ·08 mm. in diameter had lost about two-thirds of their nerve-fibres; whereas in bundles of ·05 mm. or less, hardly an undegenerated nerve-fibre was to be seen. The sheath of these small nerves was not apparently thickened, and there was no evidence of any inflammatory change having taken place. The axis-cylinders and medullary sheaths of the nerve-fibres had disappeared, and were replaced by some granular material unstained by nuclear stains, and a few small nucleated cells.

Explanation of the Symptoms observed by means of the Diseased Condition found.

Owing to this degeneration the nerve fibres are unable to convey impulses, whether they be impulses to produce sensations, or whether they be impulses which under ordinary circumstances would cause muscles to move. In the latter case those muscle fibres which are their destination degenerate also.

The nerve fibres are at first affected in a patchy manner—one or two fibres in each nerve-bundle. By degrees the number of nerve-fibres which are destroyed increases. The degeneration is confined to that part of the nerve which is close to its destination. When the nerve-trunks were examined a few inches higher up, very few fibres were found degenerated. Accordingly, the disease gives rise at first to only clumsiness; ultimately, as the number of fibres affected increases, the awkwardness becomes more marked, and eventually considerable insensibility and weakness of the limb ensues. The degeneration affects the sensory nerves more than those going to muscles, so that awkwardness and unsteadiness of gait are more prominent symptoms than actual paralysis. A sheep which cannot go a few paces without falling down will, nevertheless, when caught, kick vigorously. As the passage of impulses which should give rise to a sensation is more or less obstructed, the animal is thereby unacquainted with the exact position of its feet, and does not, in fact, know exactly what they are doing, so cannot regulate the necessary muscular efforts with sufficient nicety to secure an even progression. Consequently, it tumbles about as described.

The explanation of the loosening of the teeth is similar. When the nerve to the loosened teeth (anterior part of the inferior dental) was examined microscopically (after treatment in an appropriate manner) its fibres within about ½ inch of their destination in the loosened teeth exhibited the same degeneration as I have found in the sensory nerves elsewhere. The degeneration would cause interference with the nervous path. This interference would make the teeth insensible, and would soon lead to the animal knocking them loose. The general stupidity I attribute to the direct action of the pea upon the brain. This action is not, however, associated with any recognisable anatomical change in this organ. The agonised expression may be due to pain. Such a change in the nerve-fibres as I have described is accompanied in similar conditions in mankind by considerable pain.

* The measurements refer to the diameter of the bundles in the sections.

Possibilities of a Direct Remedy.

The possibilities of a direct remedy for the disease—by which I mean something which may be given to the animal to counteract the effect of eating pea—are, in the present state of medical science, *nil*. It may be interesting to state that a condition closely similar to the above disease, both in symptoms and also in the changes produced in nerves, is produced by slow poisoning with alcohol, some mineral poisons, and also by the toxic proteids which are manufactured by the bacteria responsible for some diseases, *e.g.*, diphtheria, in man, and may be brought about in animals by giving them repeated doses of these poisons over an extended period. From the earlier symptoms so produced complete recovery results from discontinuance of the cause, but when once marked degeneration of the nerve-fibres has occurred this is slow and often incomplete.

The only suggestion I can make for the guidance of the pastoralists is to take advantage of the fact which is brought out in the experiments that it takes about a month to produce definite symptoms by feeding upon the pea, and to so arrange their paddocking that a flock shall not remain in a pea-infested paddock for a longer period than four to six weeks at one time. The obvious remedy of removing the Darling pea is for financial reasons quite impracticable, especially upon Crown lands.

Before concluding this report I wish to express my gratitude to Mr. G. H. Gordon, of Gragin, for the manner in which he met all my wishes in connection with the experiments, and to express my appreciation of his hospitality whilst at Gragin. I have also to acknowledge my obligations to Mr. George Gross, of Gragin, to whom I am indebted for the able way in which he superintended the experiments in my absence.

APPENDIX.

Effect upon Beasts and Horses.

I HAVE had but slight opportunities to observe the effects upon animals other than sheep. One beast which I examined presented, however, the same symptoms during life, and the same degenerative changes in nerve fibre were found after death. From much information which I have received from pastoralists who have unfortunately had considerable experience of the effect of pea upon horses, I believe that the pea produces identical effects in these animals to those which I have described in sheep. From many accounts it would appear as if the eating of the pea produced on horses in some cases an immediate intoxication, so that they became wild and delirious within a few hours, quite apart from the after effects caused by continuous feeding on the plant. Such an effect certainly did not occur with any of the sheep I experimented upon. In many cases the vision of the horses would appear to be affected. I have had not had an opportunity of examining the optic nerves or eyes of such animals, but I should not be surprised to find that the visual defects were due to a similar degeneration of fibres in the retina.

*The Suppression and Prevention of Tuberculosis of Cattle and its Relation to Human Consumption.

By JULIUS NELSON,
Biologist.

Introductory.

"TUBERCULOSIS" is the scientific, "consumption," the popular term, for a disease which exceeds all other diseases in the extent of its prevalence and fatality. Human beings, domesticated and captive animals, are alike subject to it, and it is transmissible from one individual to another. Scientific investigators, with considerable promise of success, are seeking a remedy for this greatest of plagues. Already we have gained sufficient knowledge of the cause and development of this disease to enable us to prevent its appearance or to suppress it. The principles to be applied are not entirely new. Similar measures have succeeded when directed to the suppression or prevention of other diseases

"Prevention is better than cure." Even though we possessed an infallible cure for this disease, we should avoid exposing ourselves to the danger of contracting this malady. It behoves us to learn of the nature of tuberculosis and the measures necessary for its prevention. Fortunately, owing to the peculiar manner in which consumption spreads, each individual has it in his power to keep himself and his cattle free from attack, even though his neighbour be negligent of his own interest.

From an economic standpoint the farmer and dairyman should keep their herds free from this insidious disease, but it is principally for man's sake that the lower animals should be included in the general scheme for freeing the country from this evil.

While this is mainly addressed to cattle-owners, and is on the subject of bovine tuberculosis, it would greatly weaken its force were a consideration of data bearing on human consumption omitted.

Owing to the general distribution and slow development of this disease, we do not show so great a concern about its presence as we do when a plague from a foreign shore visits our country. As in this case, the fatalities are crowded into a few weeks, the public attention is aroused, panic ensues, and extreme measures are applied. If half as much care were exercised in regard to tuberculosis, this disease would disappear within a generation.

It is of primary importance that the public should realise that consumption is a plague greater than all other plagues of our country combined.

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*From the New Jersey Agricultural Experiment Station, Bulletin, 118, 30th November, 1896.

Death-rate of Consumption (Human and Bovine).

If all who die of consumption in New York City could be saved and placed in cities by themselves, each year a new city of nearly 6,000 inhabitants would be created.

In the State of Wisconsin, in 1891–92, there were three deaths from small-pox, 405 from typhoid fever, 415 from scarlet fever, 1,781 from diphtheria, 2,700 from consumption.

In Massachusetts, in 1885, one-sixth of all deaths were caused by consumption. Circular 83 of the New Jersey State Board of Health states that in New Jersey, in 1894, there were 30,000 deaths from consumption, or one-seventh (14 per cent.) of all deaths. Among the reservation Indians, in prisons and in cloisters the proportion of deaths from consumption ranges from one-half to four-fifths.

Among cattle, we do not have so full statistics, and indeed few animals are allowed to die a natural death. Veterinarians, however, know of many specific instances, and often are they called upon to condemn animals that are in the last stages of consumption. Many of these find their way to the soap and fertiliser factories. One factory reported that three-fourths of the carcases received were tuberculous.

In the report for 1894 of the New York State Board of Health, a case is referred to of one farmer having lost ten head of cattle from tuberculosis during the previous seven years. Another farmer lost over 100 during seventeen years.

In the report of the Iowa State Veterinarian for 1895 is given a case of the loss of six out of a herd of forty-one animals during one summer, and another case of five out of twenty-eight in three months.

It is well known that a number of large herds have been practically destroyed after condemnation by means of the tuberculin test.

Proportion of Tuberculous Cows living.

We shall first consider statistics secured by slaughter-house or meat inspection; next those based on veterinary inspection previous to 1890, when tuberculin, as a diagnostic agent for tuberculosis, was introduced; and finally data secured by the more thorough and recent methods of diagnosis.

As regards meat inspection, it must be observed that animals designed for beef belong to a different class from dairy and stall-fed animals, and it has been ascertained that the latter are far more affected by tuberculosis than the former. Statistics from meat inspection will vary as the proportion of the carcasses from the two sources varies.

In Munich 2·5 per cent. of the carcasses were tuberculous, distributed as follows:—Calves, ·0006; steers, ·73; cows. 5·3 per cent. Taking the cows alone, the percentages increase with age, thus:—Yearlings, ·2; 3 to 6 years old, 33; older than 6 years, 59 (or more than half) were tuberculous.

Other German cities report from 1 per cent. to 3·2 per cent. (Berlin). In Saxony the figures are as follows:—Cows, nearly 7 per cent.; steers, 3·6 per cent.; bulls, 2·6 per cent.; calves, 1 per cent.

In Leipzig a high percentage of tuberculosis was found, viz.:—Cows, 26 per cent.; bulls, 15·4 per cent.; calves, 9·3 per cent. The average for Germany is between 6 and 7 per cent.

In England the average is 12 per cent., based on figures ranging for different localities from 1 to 26 per cent.

In France but ½ per cent. of tuberculosis has been reported; contrast this with 84 per cent. in Mexico.

In our own country statistics of this sort are very few. Three per cent. of tuberculosis was found by meat inspectors at Baltimore.

On the other hand, we possess some data given by veterinarians. These are based on "condemned" cases, but as a large proportion of "suspected" animals must also have been tuberculous, it is evident that the figures are below the real truth. However, allowance must be made for the fact that only extraordinarily-infected herds were examined.

In Massachusetts, 1887-88, in thirty-four herds 28 per cent. of the animals were condemned. In 1890, the reports of thirty-nine veterinarians in seventeen States gave an average of 18 per cent. condemned.

Under the Koch test almost all the animals affected with tuberculosis can be discovered. This test has been widely applied, but as the most suspected herds were treated first, the percentages of tuberculosis thus secured have invariably been highest at first and have gradually fallen as more and more animals have been tested.

Professor Bang, of Denmark, reports that he found 38·7 per cent. of tuberculosis in 53,303 cases tested, but that the large herds included were twice as much infected as the smaller herds.

In New York State, in fourteen counties there were 656 condemnations out of 6,135 tested animals (11 per cent.); but in five other counties, only 184 out of 20,992, or less than 1 per cent., which proportion, Professor Law thinks, may nearly represent the true average for the whole State. Yet, in cities the percentage ranges from 5 to 98 per cent.

It is evident that the legislator is interested in knowing the extent of tuberculosis for the entire State; but the milk consumer is interested in knowing the percentage of tuberculosis in the locality whence he secures his milk.

Director Hills, of the Vermont Experiment Station, found 20 per cent. of tuberculosis when only 1,000 cases had been tested, or, omitting the two worst herds, about 7 per cent. When the number of cases tested in Vermont reached 14,155, the percentage was reduced to 4·53 per cent.

Dr. Stalker reports that in Iowa about 14 per cent. of tuberculosis was found in fifty herds tested.

To secure a fair percentage on which to base estimates it is needful to take a census of the cattle with reference to herds and localities, and then to test the proper proportion of small and large herds in different localities. In this way it would not be necessary to test all the cattle to know how many were tuberculous. Should only 1 per cent. of the dairy cattle of New Jersey prove to be tuberculous, the slaughter of but 2,000 animals would practically rid the State of this bovine disease. Of course the slaughter would be very extensive in some localities.

What is Tuberculosis?

This disease is characterised by the growth of lumps, called tubercles, in various parts of the body.

Description of the Tubercles.—These are generally round in shape, but vary in size, some being as small as ordinary shot, others as large as a plum, the average being like a grape. They lie either in the affected organ or upon its surface; usually several are clustered together, which have sometimes grown into masses as large as a man's head. When many small tubercles are scattered over a considerable area the lesions constitute "miliary tubercles."

Development of a Tubercle.—At the spot or "focus" where a tubercle is to develop there is first a slight inflammation, the area of which gradually

spreads as the tubercle grows. In the central part of the focus there is formed a collection of fibrous tissue. There is also a gathering of lymph cells that become enlarged and broken up. Then the interior of the tubercle becomes firmer and pale in colour; sometimes lime-salts are deposited, so that it becomes brittle, but usually the centre is composed of a yellow material, which cuts like cheese, and is called "caseous" matter. The surface consists of dense connective tissue, which may form a covering or "cyst." In the encysted condition tubercles cease to grow, being in a resting or quiescent stage. Frequently, however, the centre becomes soft. An abscess is thus formed which ultimately discharges its contents.

Location of Tubercles.—It is connective and lymphatic tissue that is involved in the growth of a tubercle. But these tissues are very widely distributed in the body, so that almost any part of the body may become the seat of tubercle, although there are, as we shall see, certain organs that are the most frequently diseased. Tubercles forming in different organs and localities have given rise to local symptoms that have received names as distinct diseases.

Varieties of local Tuberculosis.—"*Lupus*" is tuberculosis of the skin. In cerebral and spinal meningitis, the tubercles grow on the membranes surrounding the brain and spinal cord. Brain tuberculosis also causes various forms of insanity and other nervous disorders. Tuberculosis of the joints causes swelling, stiffening, and ultimate softening of the bone, thus differing from other forms of arthritis. Tuberculosis of the ovaries produces sterility; in the womb it causes chronic abortion; and some cases of "white flow" or leucorrhœa are due to tuberculosis of the womb or of the vagina.

In the udder the presence of tuberculosis has been taken for "garget," or mammitis, from which it differs in that it begins as small, localised, hard swellings, that persist, grow steadily, and are not hot to the touch. When the lymphatic glands of the neck and groin are affected, the disease is termed "scrofula." If the intestinal glands are affected, there is either chronic diarrhœa or else "irregularity" of bowels with alternate constipation and looseness. Tuberculosis of the mesenteric glands constitutes tabes. Some forms of "liver complaint" are also to be placed to the account of this disease; frequently is this organ or its portal lymphatics invaded; and even if no tubercles are present in the liver, its substance is usually very friable and abnormal in tuberculous animals. The glands situated at the back of the throat in cattle, known as the post-pharyngeal, are frequently involved; but those of the chest, where the branches of the windpipe enter the lungs (bronchial glands) and those between the gullet and the back, particularly near the diaphragm and between the hindmost lobes of the lungs (mediastinal glands), are the most frequently affected of all. Sometimes one of these glands, normally not wider nor longer than one's little finger, increases hundreds of times in volume, becomes over a foot long and very thick, and weighs more than 10 lb. This must greatly limit the breathing capacity, even if the lungs are sound. Phthisis, or "pulmonary consumption," is the name given when the lungs themselves are tuberculous. These organs are involved in three-fourth of the cases of tuberculosis, and rarely are they alone affected.

What Causes Tuberculosis.

Different kinds of Tubercles produced by different kinds of Parasites.—There are several kinds of parasites that cause tubercles to develop on both plant and animal organisms. Many of the warty growths on the bark or roots of plants are caused by parasitic fungi. The "galls" on leaves result

from the presence of developing insect larvæ. The "lump-jaw" of cattle, or actinomycosis (which is Greek for ray-fungus disease), is a hard tubercle caused by a bacterial fungus. The pimples, sometimes found on the surface of the intestines of cattle, contain each a little worm. Carbuncles and various abscesses may ultimately be traced to the irritation of some parasite. Even dead objects, like nails, bullets, &c., embedded in animal tissues become enclosed in cysts of connective tissue. These various growths superficially resemble the tubercles of tuberculosis, though an experienced man need not err in diagnosing true tuberculosis.

Tubercle Germs.—That consumption was caused by parasites was suspected long before Koch, in 1881, discovered the germs of this disease, by submitting the material in which tubercle germs were supposed to be to the prolonged action of the strongest aniline dyes, such as fuchsin. By this means the germs present are usually successfully stained so as to render them visible when properly magnified. As most other germs receive the stain in a minute or two it is no wonder that the tubercle germs remain relatively so long undiscovered. To view the germs it is next necessary to wash the preparation with a 25 per cent. solution of nitric acid in water, or in acidulated alcohol, and to submit a thin layer to examination with a microscope magnifying at least 500 diameters. The germs will then appear as very small coloured rods (or bacilli), irregularly bent, and about one hundred thousandth of an inch thick, while the length averages about ten times as much.

In caseous material these germs are generally not demonstrable by this method. But long before the germ theory of disease was established it was known that such material, when inoculated into susceptible animals, produces tubercles in which the bacilli are easily found. It is presumed that in old tubercles the germs have broken into fragments, similar to the "spores" of other germs, that are stained with great difficulty.

Tubercle bacilli are harder to kill than most other disease germs. They pass through the processes of digestion unaffected. They are not killed until heated to 150° F. for a period of nearly an hour, 160° for about a quarter of an hour. In the case of large pieces of meat the centre usually remains during cooking at a much lower temperature than the surface. However, a degree of heat too low to destroy the germs weakens their virulence.

The Germ Theory of Disease.—So many diseases have been shown to be produced each by a specific parasite of the sort known as bacteria or "microbes," that it is supposed the majority of diseases are of germinal origin. These bacteria grow rapidly and multiply by splitting in two; so that a single one will, under favourable conditions, give rise to millions in a short time. They throw off from their bodies various poisons or toxines, which produce the disturbance we know as the symptoms of diseases. When the germs have had time to become numerous in the body, they cause a rise of temperature, known as fever. In ordinary fevers the germs multiply so fast that the fever may develop in a day or two after infection; but in consumption the "hectic" fever is often delayed for years. This is because tubercle germs multiply with great slowness.

Microbes are dependent upon certain conditions of heat, moisture, &c., for their development. It was evident to all men before germs were dreamed of that diseases depended for their development upon the concurrence of certain circumstances or conditions of climate, weather, drainage, &c. It has now been proved that no conditions, however favourable to the development of disease, can of themselves produce disease if germs be absent. Disease can

develop only when two factors concur, viz., presence of germs and conditions favourable to their development. If we can change either factor we control the occurrence of disease. This discovery has greatly perfected sanitary science, for in the past we could only attempt the regulation of conditions, but now we strive even more zealously to annihilate the power of the other factor. We disinfect; we apply antiseptics and germicides.

Susceptibility and Immunity.—The condition of the body is so important in determining whether or not disease shall develop as almost to deserve consideration as a third factor, for, granted that germs are present and the external conditions are favourable to the development of disease, if several animals be equally exposed to infection, some will be attacked and others not. The former are said to be "susceptible" the latter "immune" towards the disease. These conditions may be analysed as follows:—

1. It is the function of the white cells of the blood (lymph cells or leucocytes) to swallow and digest germs when they enter the body. These guardians of health may be strong and numerous or weak and few; they may readily overcome one species of germ while they may be paralysed by another. Tubercle germs do not, as a rule, multiply in the blood, but they multiply in the lymph cells, causing the latter to enlarge and to disintegrate.

2. The number and strength of the germs that enter at once, or the frequency with which the infection is repeated, as related to the power of the body to resist the invasion, is important. The rabbit, for instance, not so susceptible to tuberculosis as the guinea-pig, will usually not become tuberculous if the germs that are inoculated have been heated to 140° F., or if they are fewer than 150 in number. Many a patient exposed to infection might have conquered had the ventilation been better, for in this way the number of germs present in the air would have been reduced, or had sufficient light flooded the room inhabited. Sunlight soon weakens tubercle germs, but we are assured that they retain their virulence for months in dimly lighted rooms. In these cases we see well the relation between internal and external conditions.

3. The amount of stress or strain under which the organism is labouring is a factor. Animals ordinarily immune can be made susceptible by exercising their muscles until they are overtired. Among other strains may be mentioned improper nutrition, overchilling, overheating, breathing air deficient in oxygen, lack of sleep, excessive nursing, forced milking, worry, and grief.

4. In the case of several diseases (questionably so with tuberculosis), recovery from one attack confers immunity against subsequent attacks. If the blood of an immune animal be inoculated into a susceptible one, it will render the latter immune also. When a patient recovers from a disease, it is supposed to have been due to the fact that his tissues have manufactured an antidote to the bacterial poison, or a counter-poison called anti-toxine, which has a repressing or attenuating action upon the germs. By cultivating germs under artificial conditions they become so changed as to make a weakened poison. These "attenuated" germs when inoculated or vaccinated into an animal produce a mild form of disease, under the stimulus of which the body acquires immunity against stronger attacks.

The toxine of tuberculosis is called tuberculin, whose anti-toxine is "anti-tuberculin." In chronic cases of tuberculosis there is not enough tuberculin secreted, or at least it is not secreted fast enough, to cause a fever. But the presence of the germs has produced some effect on the tissues, rendering them sensitive to the sudden accession of a small but appreciable quantity of tuberculin, as is shown by the occurrence of the reaction fever that is produced in tuberculous animals subjected to the Koch test. If the

injection be repeated on the same patient, the reaction is less in extent. It usually takes only three or four injections to make a tuberculous animal irresponsive to the Koch test. Some authorities have reported such cases to be cures, though it will take some time to prove this to be true. It is at least supposable, from analogy with other fevers, that the reaction produced by the Koch test may be accompanied by the manufacture of anti-tuberculin. There is great uncertainty surrounding these experiments, since repetition of tuberculin injection does not produce even a so-called (though doubtful) cure in every case, and usually after a sufficient period of rest (a year, more or less), a reaction may again be provoked. On this head see the reports of the Biologist, New Jersey Agricultural College Experiment Station, for 1895 and 1896. Cattle, at least, seem to show slight, if any, evidence of possessing immunity against tuberculosis.

The Question of Heredity.—The fact that consumption frequently "runs in families" has lent a good deal of force to the belief in the presence of a real susceptibility and immunity, which, in whatever way acquired, could be handed down through several generations. When germs were discovered, the doctrine of heredity as regards diseases was made to include cases of "congenital infection"—that is, the unborn child was supposed to have received the germs of disease from the maternal (or paternal) body. Recent observations have shown that only a very small percentage of calves are born congenitally infected. Few calves are tuberculous, anyway, as compared with adult animals; but even of these, the majority have become tuberculous from drinking milk containing germs. There is plenty of proof to show that if infection after birth be obviated, the children of consumptive parents do not become tuberculous, and, on the other hand, numerous very bad cases of consumption have occurred among men and animals whose ancestry showed no trace of this disease. If consumption runs in families, it is because the children of consumptive parents are especially exposed to infection.

Degrees of Tuberculosis.

Paths by which the Germs enter the Body.—Neglecting unusual methods of infection, there are two main avenues by which germs are received, viz., by the digestive canal with the food, and by the lungs with the dust of the inbreathed air. The resulting tubercles will show by their situation and extent of development by which of the two paths the germs entered. In any case the germs lodge first upon the free internal membranes of these organs, then they are picked up by the wandering lymph cells, and are transferred into the nearest lymph glands. These glands when charged with germs fail to guard the receiving organs, which then become the seat of tubercle. In the case of the lungs of cattle, it is the dorsal part of the posterior lobes into which the main bronchi run most directly that are most often the seat of primary lung tuberculosis. Infection of the lymphatics of the throat or of the abdominal cavity is called "feeding tuberculosis," showing that the germs were received in the food rather than by breathing. Tuberculous calves are usually cases showing feeding tuberculosis.

Secondary Tuberculosis.—Primary tubercles are those produced by infection from without. When one of the primary tubercles advances to the stage in which it discharges, its contents on their way out of the body can set up tuberculosis, not only in places where primary tubercles are capable of forming, but also in other parts of the body. We are indebted to Dr. Theobald Smith for a lucid account of this subject. Enough must be given

here to give the general reader a fair notion of how secondary tuberculosis develops, because it is in this stage that the patient becomes a source of danger to others as well as a source of reinfection and auto-infection to himself. In case the tubercle discharges in the lungs, the matter passes out into one or more of the following places—the windpipe, the chest cavity, the pulmonary veins, the thoracic lymphatics. From the windpipe the discharge is coughed up and either expectorated, to become a source of infection to all (including the patient) who breathe the air laden with this dust, or the discharge is swallowed. Some of the germs must stick to the mouth and lips, from which they will infect the throat glands. Those swallowed reach the abdominal lymphatics, and some escape with the fæces, to become a source of danger to other animals, such as pigs. In the case of cattle, the coughed-up mucus (sputum) is usually swallowed, but at times some enters the mouth and nasal cavities. Then the germs may be carried in the slime or "drool" that comes from the cow's muzzle.

If the discharge is into the chest cavity, miliary tuberculosis will be set up on the serous or pleural membranes of this cavity, the front side of the diaphragm and other thoracic organs. If the discharge passes into the blood-vessels the germs will be carried into every part of the body, such as the brain, joints, kidneys, udder, &c., thus setting up what is termed generalised tuberculosis, the worst sort of all. The germs may then enter the milk, the urine, the vaginal discharges, &c. Infected milk dripping to the barn-floor becomes a source of tuberculous dust. If a sound cow lies in the infected stall the germs will cling to the outside of her udder, to fall into the milk pail or to be received by her suckling calf. There is no end to the possibilities of infection after an animal once begins to pass off germs. Large herds have become greatly infected from a single case of advanced tuberculosis. In case the discharging tubercle is one of "feeding tuberculosis," the germs may either pass out through the intestines or may produce miliary tuberculosis of the peritoneal membranes, and on the abdominal organs; or if they are carried into the thoracic duct they will infect the lungs by way of the general circulation. Injection of germs into the abdominal cavity frequently causes tuberculosis of the lungs, in experiments conducted upon animals.

Milk as a Source of Infection.

The danger to human beings, especially infants, from bovine tuberculosis, lies in the chance of infection from cow's milk. There is probably slight, if any, danger in the use of milk from cows while they are in the primary stages of tuberculosis. The danger becomes real in the secondary stages. Then the udder usually becomes infected, though not always right away. Ernst found the udder free from tubercles in 14 per cent. of cases of tuberculosis advanced far enough to be diagnosed by veterinary inspection; nevertheless, in one-third of these animals (tuberculous cows with sound udders) he found tubercle bacilli in the milk.

Symptoms of advanced Tuberculosis.

In the early stages of primary tuberculosis the health of the animal seems to be unaffected; frequently the patient shows an increased tendency to lay on fat. Unless the lesions are in the lungs, the veterinarian usually has great difficulty in diagnosing the disease. But the symptoms of secondary tuberculosis are very evident. No person should keep a cow alive which manifests any of the following symptoms; nevertheless it has frequently

happened that such animals have been milked as long as they could stand up. Beware of the cow which, if well cared for, has a long-legged, pinched-chested appearance, with shoulder blades sticking out, back-arched, and with a pale, emaciated look. The skin is dry and hidebound, the coat lacks sleekness, the milk is deficient in fat, decreasing greatly in yield. The fæces are dark, pungent, and watery. Laxatives, when administered, act too readily. Beware of the cow with ill-shaped udder, containing hard lumps, or with swollen lymphatics. When pressure is applied to the chest-wall the animal shrinks away from the hand. If the temperature in old animals frequently exceeds 103° F. at 5 p.m., it is cause for grave suspicion. On the other hand, in the morning the temperature is usually abnormally low. A cow extra stupid, or extra excitable, always bulling and subject to sterility or to abortion, is probably tuberculous in the brain or in the genital organs. A persistent cough is present, or if there be only occasional cough while standing still, this may be increased by exercising the animal or by pressure on the chest, or by giving drink.

If by veterinary inspection all cases of secondary tuberculosis could be removed, we might by this means succeed in suppressing bovine tuberculosis. At any rate such inspection should never be neglected. Both owner and inspector should be held legally responsible if cows evidently tuberculous are kept for milking purposes.

But ordinary physical inspection in diagnosing tuberculosis is not sufficiently reliable to give us hope that by its means alone we could keep down this disease, although with proper care we could greatly restrict its development. In the Koch tuberculin "test" we have a means of discovering not only all animals that are dangerous or liable soon to become dangerous, but also cases in early stages of the disease that may not become dangerous, at least for a long time. Unfortunately for the popularity of the "test" it fails to show to which of these two groups the reacting animals belong. It seems a waste of effort and unnecessarily severe to condemn animals slightly affected, equally with dangerous cases. Yet who thinks that could we suppress tuberculosis in no other way, that this price is too great as compared with the benefits to be secured?

The Tuberculin Test.

Robert Koch announced in 1890 that if a glycerine extract of the toxines of tubercle germs, called by him tuberculin, were injected into tuberculous animals, a fever would be caused in from six to twelve hours after injection, which would last for a number of hours. He believed that repeated injection would cure tuberculosis, but it was soon found that in advanced cases in human beings the disease was really increased by such injection.

Is the test injurious?—The reaction fever is absent if no tuberculosis is present, but some effect is produced even then, for there is a decrease in the milk yield, which is greatest in about four days after application of the test, and then gradually the normal yield is restored. Dr. Law thinks that large doses do cause a rise of temperature even in healthy cows. The amount ordinarily used is twenty-five drops of diluted tuberculin for each thousand pounds of weight of the animal. This quantity does not affect the temperature of sound animals.

Tuberculin which is properly made has been subjected to heat so that the germs in the "lymph" have been deprived of their vitality. The uniform experience of those who have made thousands of tests is that no injurious effects have been noticed even after repeated injection of sound or of slightly-

tuberculous animals; indeed, the latter appear to be benefited. But as regards the effect upon some thoroughly-tuberculous animals, opinion is divided.

Procedure in making the test.—To diagnose the presence of tuberculosis by means of this test, it is necessary to observe whether or not the temperature of each animal is affected by the tuberculin it receives. This constitutes the only real difficulty, because the temperatures of different animals is different at the same time; young animals usually are warmer than older ones; the temperature of the barn affects different animals unequally; the drinking of water lowers the temperature for a period as long as an hour afterwards; the presence of other diseases, the approach of calving, and the presence of rut (œstrum) usually raise the temperature; but that which causes most difficulty is the fact that the temperature of each animal is constantly fluctuating between a higher and a lower degree—different with different animals, and different on successive days. The average of observations taken every half hour or so, shows that generally the temperature is lowest in the morning and at midday, and highest about 9 a.m. and 5 p.m. But there are exceptions.

The best that can be done is to observe the temperature of each animal at intervals of not less than two hours, during the day, to ascertain the normal fluctuations of temperature. About bedtime, the proper quantity of tuberculin is to be injected under the skin of the shoulder as the most convenient place, after rubbing the spot well with a 4 per cent. solution of creolin, as an antiseptic precaution.

Then during the following day the temperature is to be observed as it was during the first day. The reaction will occur by 9 a.m. or earlier, or it may be delayed until the afternoon. The higher the reaction the sooner it occurs and the longer it lasts. In a typical case the temperature will begin rising as early as 6 a.m., and may reach 107° F. by noon. In case the temperature rises only slightly, say fails to reach 103° or 103·5°, it will usually be impossible to be sure that such rise is due to tuberculin.

Sources of failure and limitations of the test.—1. Cows with advanced tuberculosis fail to react. The tuberculin naturally present in such animals has already caused reaction (the hectic fever) so repeatedly that no great reaction is possible. As such cases do not require tuberculin injection to discover their diseased condition, this source of failure does not count against the value of the test.

2. Cases of slight reaction are not distinguishable from cases in which the temperature of a sound animal is a little higher one day from what it was the day before. To destroy the former it is necessary to arrange them in the order of their certainty, and, beginning with the most certain ones, to slaughter them *seriatim* until the carcasses cease to show the lesion of the disease. Or these cases may be reinjected six or more months later. If they are sound to physical inspection, it may be considered as perfectly safe to let them wait.

3. Cases that have been previously injected and have given reaction, give a less certain reaction at a later test. Experiments show that the power to react is regained after six or more months of rest. Different cows differ in these respects. Prof. Bang found that 7 to 20 per cent. of the cows lost the power to react on the second injection; others require three or four repetitions before losing sensibility. Some observers report that a reaction can be secured if a sufficiently large dose be injected.

4. Cases of recent infection, and some cases of latent disease, fail to give a reaction; but these can be secured by testing the entire herd again later. Prof. Bang found that on a second injection of some herds he secured 10

per cent. additional reactions, but the third injection added only one animal; so that if a herd be tested two or three times within two years, it may be practically freed from cases of this disease.

5. Very rarely has it been found that animals with diseases other than tuberculosis respond to the injection of tuberculin. Prof. Bang found two cases of reaction in which the *post-mortem* failed to show presence of tuberculosis. Evidently these cases are too few to be counted against the test. After including all sources of errors, the tuberculin test applied by experienced persons shows at least 90 per cent. of efficiency. By its aid we are able to eradicate bovine tuberculosis.

This desirable result has been aimed at by the dairymen of Denmark. Such success has been attained that they have great hopes of succeeding. It will be remembered that in that country bovine tuberculosis is much more prevalent than it is here.

The Danish Method of Eradication of Tuberculosis.

This method, based upon extensive experiments by Prof. Bang, is voluntarily adopted without government compulsion, the self-interest of the farmers being sufficient stimulus. In this work there are ten steps to be taken.

1. The herd is inspected by a veterinarian, and all evidently tuberculous animals are at once removed and carefully slaughtered.

2. The remainder of the herd is tested with tuberculin, given free by the Government, provided the farmer agrees to follow, rigidly, the remaining steps of the process.

3. All cows that react, and all adult animals of little value that have shown evident reaction, are carefully slaughtered under inspection. If the beef seems to be prime, the carcass is marked as having been slaughtered as tuberculosis beef. Those who buy it secure it at half-price, and, of course, if it is thoroughly cooked, it is as safe for food as any beef.

4. The remaining reacting animals are carefully separated from the non-reacting animals, either in a separate building or in the opposite end of the same building, a complete partition being at once constructed between the two divisions. The partition is made of matched boards, and is papered. There is no opening left by which air can pass from one compartment to the other. The drainage is so arranged that nothing can soak beneath this wall. If possible, a separate set of attendants care for each division. Where but one man milks and cares for all the cows, he serves the sound division first, then he changes over-shoes and outer garments for special clothing used only when with the reacting division.

5. Both compartments are cleaned and disinfected as follows: All manure and litter is removed and burned or treated with germicides. The floor, walls, and ceiling are wiped with a wet rag, frequently rinsed in disinfectant solution. Then the entire interior is sprayed with one of the following solutions, either *a*, *b*, or *c*:—

(*a*) One pound chloride of lime in 4 gallons of water.

(*b*) One-half gallon crude sulphuric acid slowly mixed with ½ gallon crude carbolic acid, then slowly diluted with 20 gallons water.

(*c*) In a wooden tub put 8 gallons warm water, add 1 oz. of corrosive sublimate; let stand a day to thoroughly dissolve. This is a powerful poison. It must not be used in contact with metal instruments, but can be applied with a brush. All parts that can be reached by the tongues of the animals must be rinsed off with pure water after this disinfectant has been applied.

When walls and ceiling are dry they are whitewashed. (Corrosive sublimate can be added to the whitewash.)

6. All the milk produced by the reacting animals should be heated to 185° F. before use. No milk should be given to the calves without this Pasteurization process unless its purity is undoubted.

7. All calves dropped by reacting cows should be put with the non-reacting division before they get a chance to suckle their mothers. For the first day they should receive their mothers' colostrum (milk) after heating it to 149° F.

8. The sound herd should be tested a second time within a year, and all reacting animals removed to the other division.

9. In buying a new cow she should be tested at once, so as to know in which division to place her.

10. The reacting herd should be inspected by physical examination at least once a year, to discover if any cases have become so advanced in tuberculosis as to show physical signs of the disease, when they should be sent to the slaughter-house as tuberculous beef.

By this method the unsound herd will, in time, be wiped out, but not before it has replenished the sound herd to its original dimensions. Of course, if only a few animals are found tuberculous, it will not pay to go to the expense of keeping a separate herd; but when dealing with a considerable number of prize animals, whose qualities are worth propagating, it will undoubtedly pay to follow the Danish method. It is simply a question of which is the cheaper course in the end, to try to raise a sound herd from an unsound one by observing rigid rules, or to get rid of all the tuberculous animals at once. Each farmer must determine this for himself.

At any rate, to keep one's herd free from tuberculosis, after it is once purified, or even to thoroughly purify a herd, requires just that careful attention which is necessary in applying the Danish method. This method is in itself a most remarkable educator, and the principles that underlie it are part and parcel of the general biological principles that interest all intelligent breeders. It is certain that if our people are left in ignorance and without this practical education, that in spite of a wholesale slaughter of tuberculous animals, it would be but a few years before the herds of the country would again have become as infected as they are now.

What to do to keep Tuberculosis from developing in Ourselves.

If we have no guarantee that the milk we are using or are giving to our children comes from a purified herd, it should be placed over the fire and heated to 170° or 180° F. In the absence of a thermometer, it is only needful to see that it stands on the fire long enough to form a thin skin over its surface, and that little bubbles of steam gather beneath. This heating, if stopped at this point, does not produce "boiled" milk. Boiled milk, if not scorched, is greatly relished by many people. While it is true that raw milk (like raw eggs, meat, oysters, &c.) is more easily digested than that cooked, this is not sufficient reason for limiting us to its use in the raw state. Cooking will also destroy other bacteria, which are always present to a greater or less extent, though these are usually harmless. Milk, even when cooked, is the most perfect of foods and the safest.

Consumptives will, of course, need but to know that their sputa contain germs, to cause them to disinfect or burn their expectorations. They will cease to live in darkened rooms. They will insist on having the carpets removed and never more have their rooms swept, but will always have

the dust wiped or washed off. Cold air is much better than warm for consumptives, who should also keep away from health "resorts," because these, as well as the hotels, cars, &c., used by the patients, soon become badly infected. Of course, a properly-conducted sanitarium is not open to the last objection. As to diet, it is important to greatly increase the use of fruits and fatty foods. Nuts are excellent. Fats are readily digested if a liberal amount of fruit and salt be eaten at the same time. These points may also be worthy of attention in preparing rations for cattle.

People who wish to keep from getting consumption should not expose themselves in places where the ventilation is inadequate. If they should dress as one does when about to take a buggy ride, they would be able to sit in any sort of weather, in any place, with windows open. Our public halls and railway coaches in winter time are efficient death-promoting agencies. It is also important to screen all food that is not to be cooked, from flies, as these insects may carry all sorts of germs.

The Contagiousness of Tuberculosis.

Any disease produced by germs is contagious, infectious, or "catching." In such disease there are special ways in which the germs are transferred from a patient to a healthy person. We have learned enough about consumption to know what constitutes exposure to this disease. As no one knows at any one time to what extent he is exposed, and as this disease takes a long time to develop, it is quite difficult to connect any particular case with a particular act of indiscretion. Under the circumstances, people in general have no very positive belief that consumption is really a contagious disease, though this has been definitely proven by scientific experiments. Many coincidences of exposure to the germs of consumption with development of this disease, which would be of uncertain value as proof of contagiousness if taken by themselves, are very suggestive when viewed in the light of the knowledge that this disease is a germ disease. In this connection one bit of positive evidence outweighs hundreds of merely negative instances. As the care which people will exercise in dealing with this disease will largely depend on the firmness of their belief in its contagiousness or its infectiousness, efforts to establish this belief are of value. Hence we shall proceed to refer to a few instances recorded by different writers.

In 1860, Chauveau fed "scrofulous" products to cattle and produced "scrofulous" (consumptive) disease. Bollinger fed the milk of tuberculous cows to guinea-pigs and tuberculosis developed in them. One way of testing milk to see if tubercle germs are present, is to inject a quantity into the abdominal cavity of guinea-pigs. Even when the germs are present in so few numbers as to be incapable of demonstration by microscopic examination, the inoculated animals become tuberculous. Ernst inoculated milk of tuberculous cattle with sound udders into guinea-pigs, and half of the inoculated animals became tuberculous. Milk from these cows fed to a number of swine caused half of them to become tuberculous. Drs. Stalker and Niles separated three calves from their mothers at birth, and gave them the mixed milk from several tuberculous cows, but always heated the milk that one calf received. This animal did not become diseased; the other two became tuberculous. Dr. Schrœder found that one sample out of nineteen, secured from the general milk supply of Washington, D.C., produced tuberculosis when inoculated into a guinea-pig. Dr. Ernst found three out of thirty-six samples of Boston milk to be similarly infectious. Prof. Bang placed two healthy bulls with the reacting division in his experimental herd,

and within a year they too reacted when injected with tuberculin. Cornet inoculated guinea-pigs with dust from rooms occupied by consumptives, and compelled other guinea-pigs to breathe such dust, and produced tuberculosis in the experimental animals. It is a general observation that when cows occupy the same stalls and do not intermingle, that tuberculosis spreads from the diseased animal to its nearest neighbour first; while in case the stalls are used indiscriminately, the entire herd is irregularly affected.

Many infants die of bowel troubles that suggest "feeding tuberculosis." It has in a number of cases been found that the milk received as the sole food by such infants was received either from a consumptive nurse, mother, or tuberculous cow. In Dr. Ernst's extensive correspondence with physicians on this subject, he found eight cases reported in which infection was conveyed from mother to child, eleven cases of transfer from cow to infant, and sixteen cases where this mode of infection was suspected. Veterinarians are better situated to observe such cases than ordinary physicians. Dr. Stalker reports that five young people in one family died of consumption during two years, and their ancestors had been free from such disease. An investigation of the herd belonging to the family showed that it contained seventeen tuberculous cows, and others had previously died of tuberculosis.

Cases are on record of the children of non-tuberculous mothers, both human and bovine, being nursed by foster-mothers who were tuberculous, and who had lost their own offspring from this disease. The previously-healthy young, under these circumstances, begin at once to pine away and finally die from tuberculosis. Prof. Bang reports that tuberculous horses are rare except in Denmark, where the unique practice prevails of feeding these animals cow's milk. Where pigs are fed milk from tuberculous herds, they show a large amount of tuberculosis. A case was reported to the Paris Academy of Medicine of an outbreak of consumption in a girl's boarding-school. Five girls died from intestinal tuberculosis, and this led the physician to suspect the food. He found that this school had been supplied with milk from a cow with a tuberculous udder.

In concluding this valuable paper Mr. Nelson adds:—"Other instances will be found reported by the different authors who have treated this subject"; and he gives a long list of works published in Europe and America during the past thirteen years.

Pruning, Grafting, and Budding.

W. J. ALLEN,
Fruit Expert.

Though each kind of fruit requires a somewhat different treatment, peculiar to itself, for producing it in the highest state of perfection, still the principal conditions are applicable to all.

Soil varies so much in parts of this Colony that the orchardist cannot be too careful in selecting land which has proved to be well adapted for the culture of fruit. The red loam is considered one of the best in the Colonies; but there is a rich dark soil, particularly in coastal districts, where fruit-trees do exceptionally well. Great care must be taken in attending to the draining wherever necessary. Trees planted in light soils, with a gravelly subsoil, will generally grow and bear well without any draining; but where clay subsoils are encountered, drainage will have to receive more attention, as wet, sour, soggy land is very injurious to trees, and if not properly drained, will very often cause the trees to die.

Such soils may be successfully drained by inserting pipes at a sufficient depth, and at regular distances, so as to carry off any surplus moisture, and thus alter the whole nature of the ground. Water no longer stagnates, the soil is made warmer, the sun's rays have their full beneficial effects. Rain passes through drained soil more easily, and with it air, carbonic acid and ammonia; the trees make a fuller and healthier growth, and produce full crops of the best fruit.

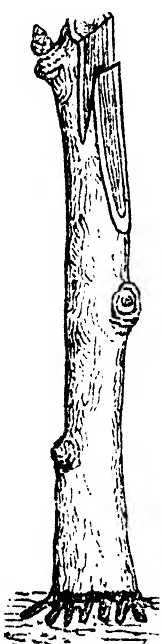
Before we start with the subject of pruning, I wish to say a few words about grafting and budding, and the methods commonly adopted for raising trees of any certain variety, after once the planter has decided which particular sort or sorts he wishes to raise; and in this connection I must impress upon readers the necessity for planting only such fruits as have a marketable and commercial value. Oftentimes the nurseryman, out of a great number of varieties, may find only one particular tree which he will consider of sufficient value to propagate, and as this can scarcely, if ever, be done by planting the seed, he needs must increase this variety by the processes of grafting or budding.

These are the means most commonly used for propagating fruit-trees, and everyone interested in either the garden or orchard should be able to perform these operations, as they are then capable of effecting transformations and improvements in their trees and bushes which at times may prove very valuable.

Grafting.

The proper time for grafting the trees is in the spring, when the sap begins to flow. The scions are selected while pruning in the winter, and for this purpose select only straight, healthy wood from vigorous trees that have

borne good fruit, and use only such wood as has fruit-buds on it, as these are found to produce the best bearing trees. The stock usually used for grafting upon is from one to two years old, and in preparing for this work the nurseryman or gardener often digs up all of his trees in the winter and heels them in closely together, and when ready for work removes them as he may require to a room, cutting the tops off to within 4 inches of the root before taking them inside. This is called bench grafting. When the roo t or stock is out of the ground it can be more easily handled, and one man can easily work 400 trees in a day when he becomes accustomed to the work. As soon as trees have been grafted in this way they must be either planted out in the places where they are to grow in the nursery row or garden, or if this is not convenient, they may be heeled in for another week; but the latter course is not desirable if it is possible to avoid



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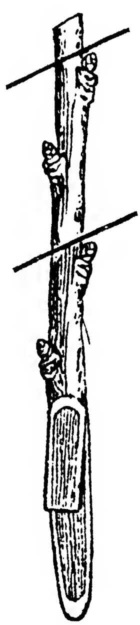

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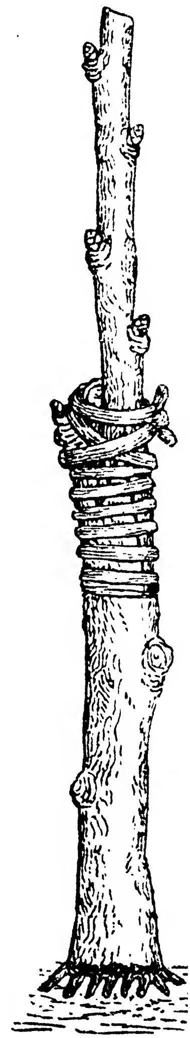

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it, as it means an extra handling and a risk that the scion may be displaced, thus reducing the tree to a seedling once more.

If stock is grafted after trees have been planted in the nursery-row, where they will be grown until fit to plant out in the orchard or garden, remove

the earth from the base of the stock, so that the tree can be worked around more easily; then cut the stock off about 4 inches above the roots; then make a slanting cut, as shown in figure No. 1; then take a scion with at least three good buds on it, make a corresponding cut in it, as shown in figure No. 2; join the two together, so that the inner bark of the scion adjoins and touches the inner bark of the stock, as shown in figure No. 3, and tie with either waxed cloth, twine, or calico (see figure No. 4); after which hill the earth well up, so that only the top of the scion can be seen, and allow the soil to remain thus until the scion is well united with the stock, and until growth is apparent, when it will be necessary to remove the earth to enable the disbudding to be properly done.

In grafting vines, where the nurseryman or orchardist wishes to graft different varieties to phylloxera-resistant stock, the latter should be planted out in vineyard form for one or two years wherever it is to be grown, so that the stock may attain a strong and vigorous stem before grafting is commenced. This will enable the scion to be inserted well above ground—a very necessary precaution—because, were the general rule of grafting to be followed, and the scion inserted level with or under the surface, the probability is that it would unite with the stock, but at the same time would throw out a root growth from which the vine would be fed, and thus render ineffective the attempt to produce phylloxera-resisting vines. Grape vines should be grafted when the buds are bursting in the spring. The scions can be kept back by burying them in a cool, airy place in the earth.

The range in grafting for fruit-trees in ordinary culture is—apple on blight-proof apple stock (Northern Spy or Winter Majetin); pears on seedling pear stock for standard tree, or on quince stock if dwarfed; peach on peach; apricot on apricot; plum on myrobalan; nectarine on peach; almond on almond (but never bud either apricot, peach, or nectarine on almond stock, as it will always result in a failure); cherry on cherry; orange and lemon on orange stock—preferably sweet or bitter.

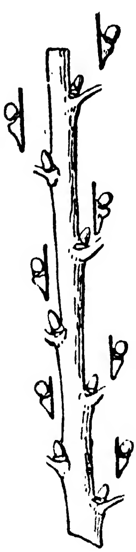
Budding.

This method of working buds or stock to different varieties of trees is not only very simple and effective, but also very economical. Two men can easily bud and wrap a thousand trees in one day—the budder inserting the bud in its proper place in the stock, and the wrapper following after him and tying the buds securely. To begin, be very careful in selecting the buds, taking them only from trees that have borne the best quality of fruit, and using only well-developed buds.

Budding is performed for summer buds about Christmas time, or as soon as matured buds can be found on summer shoots. If stock is in good growing condition it can be done at any time, although it is best not to choose days when there is a hot, dry wind blowing. Medium sized shoots afford the best buds, the top and basal parts being respectively too soft and over-ripe. It is essential that the buds be on wood that is half ripe, plump, and having no further growth to make beyond maturing. I prefer using wood buds that have clustered around them two or more fruit buds. They are easily distinguished as being long, thin, and pointed, while fruit buds are thick, round, and blunt, except in apricots, which have flat wood buds, the blossom buds being somewhat pointed. Where there are two or three buds at a joint, one is usually a wood-bud. This applies to the apricot, peach, nectarine, cherry and plum. The shoots of all kinds of fruit trees from which the buds are to be taken must be healthy, and the more quickly they are

inserted the better, and this is the reason why men accustomed to the work have better success than amateurs, as they never mutilate a bud when cutting it, and from the time they cut it until it is inserted is only a matter of two or three seconds. Shoots can be carried and packed in damp moss or other material to prevent them from drying. While it is desirable to keep them cool and wrapped in something damp, I could not advise putting them in water, as this tends to soften the bark, and when dried it will be found to be slightly wilted, which is to be avoided. A competent operator when budding always carries his buds wrapped in a piece of damp bagging, and in cutting the bud off at the shoot he uses a very sharp budding knife, and severs it from the shoot in one clean cut and with a small

A



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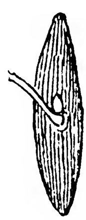

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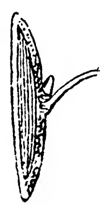

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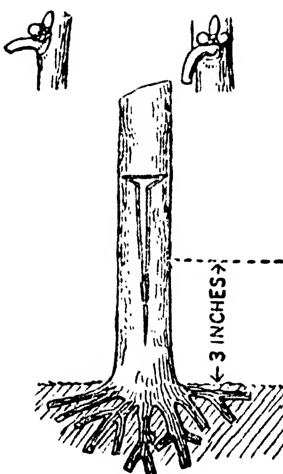


Fig. I.

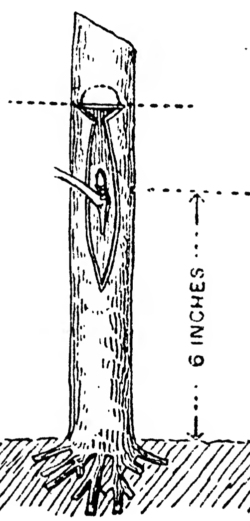


Fig. II.

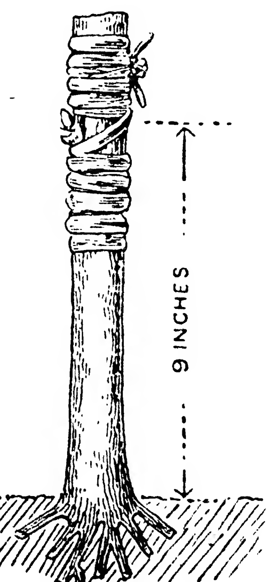


Fig. III.

slice of wood—this he never takes out. Before cutting his bud, he has made in the stock a tee-shaped slit, and the little wood remaining on the bud gives it strength enough to be slipped into its proper place in the stock without

having raised the bark, as is necessary when the wood is taken out of the bud. This method is mostly adopted in all large nurseries; and speaking from experience, out of 16,000 buds put in citrus stock last year, only 1 per cent. did not take. It is also a suitable way of working deciduous trees, and I have found the result quite as good. During the last few years I have had budded in this way over 200,000 trees of different varieties of peaches, apples, apricots, oranges and lemons.

Fig. IV.

The process of budding is very simple, and cannot be misunderstood on following the illustration. A is the shoot of the current year's growth, from which the buds are taken for transference to the stock. The buds shown in the axils of the leaves are the wood buds; fruit buds are shown to the right and left of the shoot, and double and triple buds at its base. I prefer the latter. The leaves should be detached close to the buds. The bud taken is shown in B, reverse side D with wood on; C shows the bud in same profile, ready for insertion. Now we turn to the stock. Fig. 1 shows the cross-cut vertical slit with bark slightly raised by the knife when making the cross cut, enabling the point of the bud to enter easily, after which it forces its own way down, and in consequence is in quite firmly. Fig. II represents the bud inserted, and fig. III shows the bud made secure by tying. From 3 to 6 inches from the ground have been found the most suitable distances for working the majority of our trees.

The best time for budding is in the autumn. In the winter the stock can be cut off to within 4 inches of the bud—that is, for deciduous trees. If citrus trees, it is best not to cut until growth starts in the spring. Only one shoot must be allowed to grow from each bud, and when this has grown about 8 or 10 inches it must be tied to the stock above the bud. Keep all suckers off the stock, and laterals must be kept off of the buds, and as soon as the bud is sufficiently strong to support itself, cut the top part of stock back to the bud, as shown on dotted line, Fig. No. IV. This for deciduous trees. If citrus they should be kept staked, if growing very rapidly, or they are liable to be broken off with winds.

Pruning.

There is a great diversity of opinion about pruning, and I certainly think practical experience is necessary to enable a man to become an expert at pruning. I have known many men who could go through the whole theory

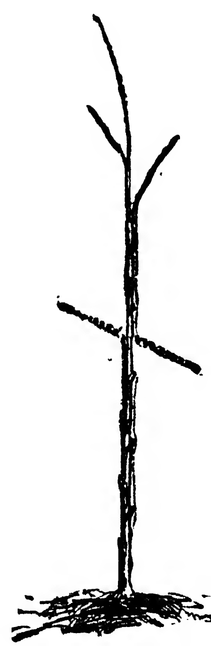
of pruning, but if you put a knife in their hands and asked them to prune an awkwardly grown tree they would not know where to commence. I do not say that theory is no good at all, but it is of very little good without practice; and I will now endeavour to present to our readers the methods in vogue in California, and which have been adopted in many parts of Victoria with the very best results.

To begin with, pruning must be done systematically and at the proper times, as, if neglected, not only will the tree itself deteriorate but the quality of the fruit also.

It is a means to an end, and in performing the operation the system adopted must be governed by the character of the tree or plant and the object to be attained. This object should in all cases be to produce a well-balanced tree, with sufficient strength to carry a full crop of good fruit, and with sufficient head to protect both tree and fruit from the effects of sunburn.

In pruning young fruit trees, the object of the planter is to encourage a strong growth of wood, so that the tree may increase in size, with a good substantial stem or trunk, and with branches so starting from the tree that they will be strong enough to hold a good crop of fruit. The stronger the growth the sooner will they make a thrifty and profitable tree.

Before describing this most important operation, it will be clearer to everyone if we begin at the beginning. Assuming that a tree is about to be planted, the tree-holes are dug and the trees at hand ready for planting. By examining the roots they will be found to be more or less cut with the spade and bruised in places. These rough cuts and bruises will heal more readily if they are cut with a sharp knife, and in such a manner that when the tree is planted the cut will face downwards. By cutting this way new roots, which will form or rather grow from the cut will have a tendency to grow in the required direction—downward. Care must be taken not to plant too deep. Trees should not be planted any deeper than they were when in the nursery. The roots should be carefully spread, and loose damp soil filled in around them to the required depth.


Cutting back at Planting.

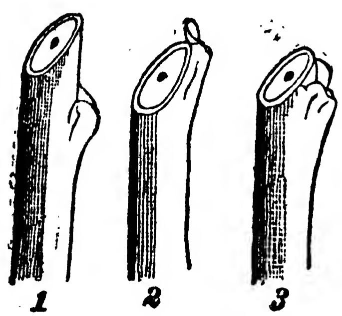
Having planted the tree we have to consider that it has lost much of its roots, consequently the roots which are left are unable to sufficiently support or nourish the growth above ground, for which the whole root system was intended. We must, therefore, shorten the top in such a way as to establish the lost equilibrium, and the planter must bear in mind that it is always better to cut a newly planted tree back rather severely than to leave it with too much top, as by so doing it will recover more quickly, and in the end make a much better tree. A tree not properly cut back may live and grow, but it will probably be years before it becomes the fine vigorous tree which one properly pruned at planting will be.

We have now come to a much disputed point, namely, what shape will be the most suitable to our purpose. Some prefer the high head; but I fear

there are only a very few districts where this kind of tree will do well, and that would be in deeply sheltered localities, where they were not exposed to winds during the bearing season. This being the case it would be very undesirable for the orchardist in Australia to prune after this method, as the winds are usually very strong at the time the fruit is all on the tree; hence I would strongly recommend the low head or vase shape, and this I might say has given every satisfaction in parts of Victoria where I have been. The crown of the tree being low it will resist the ravages of high winds better. By a low head I mean a head starting from 18 to 22 inches from the ground. Some contend that this is too low, and that it entails too much hand-work, but I will endeavour to show how low heads can be formed that will enable the orchardist to cultivate fairly close to the tree. Trees pruned in this way have an advantage over the higher crowned trees in that they can be reached more easily in pruning, fruit can be more easily gathered, the trunks are shaded, thus preventing them from being sunburnt (which latter means a stunted tree), and the roots around the tree are also shaded.

How to obtain a low head.

To obtain this end the tree should be cut down to the desired height—I prefer 18 inches. In cutting back, care should be taken to do it properly, a sharp knife being the best for small trees. Place the knife opposite the base of the bud and draw it slantingly upwards, just clearing the upper end of the bud. This will not leave dead-wood, and the cut will heal quickly. The following sketch will illustrate the distance from the bud at which the cut should be made.

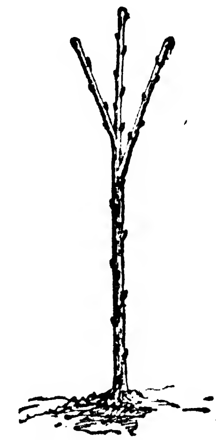


No. 1—Showing cut too much above bud.
No. 2—Showing cut too close to bud.
No. 3—Showing perfect cut.

It is injurious to leave too much wood above the bud, as it would only dry and prevent the healing process; and, on the other hand, if the cut is made too close the bud would only die.

Having cut the tree to the desired height, allow the top three or four buds to grow, care being taken that these shoots start from different points along the stem, and at even distances. This tends to make a stronger tree, and one that will not easily split as would be the case were all allowed to start from the same point. I have often seen trees which had been allowed to grow in this style, so badly broken that it was found necessary to remove the whole top, as the weight of the fruit had split the branches in all directions. We should, therefore, select three of the best branches, situated evenly around the tree, and 3 or 4 inches from each other. The rest in some cases should be rubbed off with the thumb and forefinger, and in other cases, where the tree is very much exposed, they may be simply pinched back to about 2 or 3 inches, or just sufficient to shade the trunk and protect it from sunburn until the top is sufficiently large to do so. This will tend to strengthen the trunk considerably. The growth from the three chosen buds has to be carefully watched, and the growth of the most vigorous pinched off, thus causing a temporary check, and allowing the others to grow up to it.

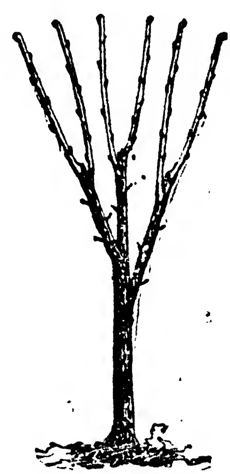
However, if they all do well, it is best to let them grow undisturbed. The more leaf-growth a tree is allowed to make the healthier and stronger it will be. The leaves act as respiratory and digestive organs to plant life, and the more we retard their formation, the more we check the growth. At the proper pruning time—July or August—the tree should be cut back to within 6 or 8 inches of the original height at which it was cut, thus giving the young tree the thoroughly strong foundation upon which so much depends.



First Winter Pruning.

In cultivating around trees, care should always be taken to see that no part of the harness is allowed to catch on these short limbs and break them. A careful hand should always be in charge of horses when working around trees of any age, as the careless workman can easily do more damage in a day than would pay his wages for a week. Fruit-growing can only be made to pay when it is made a study, and economy and attention to detail are very imperative. The orchardist's aim should be to work the soil well, making the horse and cultivator do everything that it is possible for them to do.

We now come to the second season's growth. At the end of the three branches which we have left we select and leave two buds on each branch, rubbing off the others with the thumb and forefinger, or pinching them back to within 2 inches of the branch, and thus helping to shade it from the sun. The two selected buds should be watched during the summer months, handicapping them just the same as we have done the three the first season. On no account should we allow them to gain the upper hand, and if growing luxuriantly they should be pinched back from two to three times.



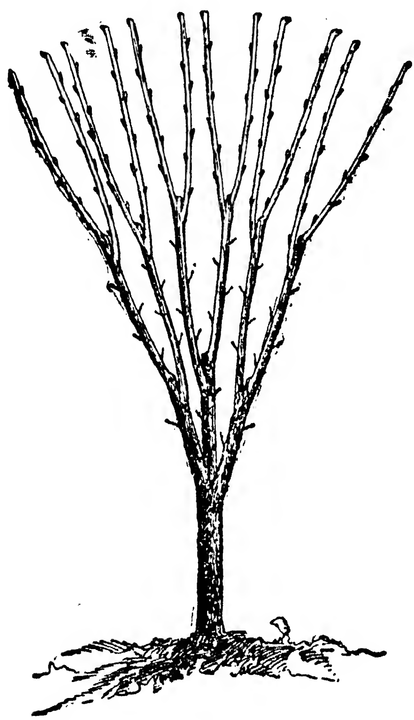
Second Winter Pruning.

The second pruning.—The growth from the two buds on the three branches will have given us now six shoots which we have to shorten back to about 18 inches of the previous year's cut. Six branches growing at fairly equal distances apart have great resisting power against winds, and are in such a shape that the horse with any ordinary cultivator can get quite close to the tree.

From these six shoots or limbs we allow two good buds to grow on each, as in previous years, pinching the remaining buds back to 2 or 3 inches, and the twelve which we have allowed to grow should be summer pruned according to the growth they make. If growing rampantly this may have to be done twice.

We should now have at the end of the third year a strong upright tree, well balanced, ready to begin bearing, and one which will stand up and bear a crop of good fruit. Never allow any fruit to set the first year; the

second year only an odd one or two, to find out if the trees have proved true to name, as if they are not they can now be rebudded and will not involve much loss, besides budding more readily than the third season. The third year the trees may be allowed to carry a fair sprinkling of fruit. If a large quantity has set it should be well trimmed out, so that what is left will be more fully developed, of good size, and best flavour. For the first three years the object of the grower must be, not to raise fruit, but to produce a well-shaped, sturdy, vigorous tree.



Third Winter Pruning.

The trees which give good returns under this system are the apricot, peach, nectarine, almond, plum, and apple. The pear gives better results when grown in pyramidal form, with a central stem.

Up to the stage last described the pruning of the mentioned trees is alike, but from this time onward different methods have to be adopted. Apricots, almonds, plums, and apples bear their fruit on spurs mainly. It is therefore the object of the grower to encourage the growth of fruit wood, and in summer pruning we have a powerful aid. I would not recommend pruning peach trees in summer, as I have proved from personal experience that the less you cut this tree in summer the better the tree will do, and a severe winter's pruning does not hurt it.

The orchardist who has an old orchard of badly-shaped trees may say, and quite rightly, that these hints are of no value to him. Our aim should be to start all orchards properly, and when the trees are old very little severe pruning will have to be done to keep the tree in shape. However, to the orchardist with the badly-shaped trees I might say that he can, with careful pruning, bring them into something like shape by cutting out all cross limbs, thinning out and removing all dead or dying growth, and heading in a few branches for a year or two; and if the trees are unhealthy-looking, give a dressing of stable or sheep manure—the latter, if obtainable, I much prefer, as it gives the trees a healthy colour and is more lasting.

To prune properly the pruner should have a long-handled pruning shear. They can be got in any length from 6 feet to 15 feet long, and are suitable for cutting small outside branches around the tops of the trees. For cutting off the thicker branches of the tree a good saw, called "the nest" is one which can be highly recommended, being inexpensive and composed of three saws

of different sizes, all of which fit into the same handle, and any of which can be replaced if broken.

A good pair of 9-inch secateurs, a chisel, and a mallet are also necessary, the chisel being used to smooth off any cut which it is found necessary to make in removing a large branch. All cuts should be painted over with either grafting wax, rubber paint, or a mixture of alcohol and shellac.

Pruning the Apricot.

This tree, from its infancy until it attains the age of 5 years, is one of the varieties which makes the most growth, and requires more pruning than any other tree during the summer, as if it does not receive close attention the limbs will spread out in every direction, and in consequence will be willowy and weak, and these limbs or branches will, when laden with fruit and exposed to high winds, be split and torn to such an extent that if the tree is not utterly spoilt, it will take at least two years to bring it into anything like shape again. Therefore, I would recommend most careful attention in its pruning—see that it has a strong woody growth in the particular direction in which it is needed, a well balanced, symmetrical, low head—the branches free from forks, and each branch having a separate hold of the stem.

All good varieties of apricots will, with proper winter and summer pruning, throw out small fruit-spurs from the branches, where it is very desirable to have the bulk of the fruit. The tree which has fruit well scattered over the different parts can easily carry half as much again as trees bearing fruit at the ends of the branches, this latter being the result of neglected pruning and forming. I have picked 600 lb. of fruit from a 12-year old tree, and it was all of good quality.

After the trees are 8 years old, they will require very little pruning, as they usually bear a crop every year, and in place of growing wood they produce fruit. If trees of any variety are bearing only every other year, a good plan is to prune them rather severely the winter before you expect them to yield the heavy crop, and but very little the winter before they produce the light crop. By following this method, you will soon bring the trees to bear more evenly one year with another. The apricot bears its fruit on 1-year old wood, and spurs 2 or more years old. Occasionally I have seen an orchard with all the inside spurs cut off. No greater mistake could be made, as these spurs usually bear some of the best fruit, and the grower who divests his trees of these is simply robbing himself. If it is found necessary—as is sometimes the case—to cut off good-sized limbs, the cuts should be trimmed with a chisel and painted over with a mixture of shellac and alcohol made to the thickness of paint. This keeps the wood from drying and dying back into the stem, and hence it heals more quickly.

This tree is very often budded on to peach, plum, or almond stock; but my experience in Australia is that it bears very much better when budded on its own stock, although I have seen a few trees bear fairly well when budded on the peach, and in California the apricot did better in the warm climate, such as Riverside, when budded on the peach stock, and bore more regularly.

Pruning the Raisin Vine.

The systems adopted for pruning the raisin vine vary very much, and no two districts appear to prune exactly the same. Some prefer to leave the spurs long, while others prefer them short; but I think the method generally adopted in California, and which is a modified form of the old Spanish method, is much the best.

The first year the vine is pruned back to a stem 9 or 10 inches high, leaving two spurs with one eye on each; the second year prune back, leaving four spurs with one or two eyes on each, these spurs to radiate around the top of the stem. The third year prune back again, leaving from five to seven spurs, according to the strength of the vine—five being the most desirable number unless the vine is exceptionally strong. Always keep the new spurs growing out close to the crown, and evenly distributed around it, so as to produce a compact and symmetrical crown, and never allow the latter to grow straggling, as when once the vine gets out of shape, it is hard to get it back, and it will not produce as good a quality of grape. All loose bark and dead wood should be removed from the vine whilst pruning. Summer pruning should never be resorted to as it tends to start out a second crop of grapes which are not desirable as they rob the vine of the strength which should belong to the first crop, and all of which strength is required in producing a first crop of best quality.

Table grapes grown on trellised vines should be well cut back every winter, leaving three-eyed spurs on them every 18 inches; and to produce the best quality of fruit it will be necessary to keep the vine well in hand, not allowing it to overbear, which can only end in the fruit being inferior in size and quality.

Pruning Zante Currants.

These should always be trellised with three wires. The first year only one leader should be allowed to grow. This should be trained to the middle wire of the trellis, and tied at intervals. The second year the laterals should all be pruned off, and the main branch or leader, which has been trained on the middle wire, should have one-third of its length cut off. The third year a lateral should be left every foot along the whole length of the matured wood of the leader, this lateral being long enough to bend over and tie to the bottom or underneath wire; and each succeeding year the vine should receive the same treatment, leaving shoots every foot along the leader, and tying them down to the lower wire. There is always an eye adjoining the leader on each side of the laterals, which starts out and serves for the fruit-wood for the following year.

In trellising vines which make a luxurious growth, such as zantes, sultanas, and others when planted in rich soil, it is advisable to train each alternate vine along the middle and top wires, thus giving each a greater distance to run.

The Sultana may be pruned in a similar way with very good results.

Pruning the Almond.

This tree does not require much pruning when once it has been formed. Some varieties require considerable cleaning out, as the young shoots grow so thickly in the centre, causing a net-work of twigs, which is not desirable. These for a few years should be removed, but more than this will be unnecessary, excepting where there should be a broken or dead branch, which will have to be removed and cross limbs taken out. Most of the crop is grown on the laterals, and these are, as a general rule, quite strong enough to bear the heaviest crop imposed upon them.

Pruning the Fig.

This tree requires very little pruning after once it has been started, more than cutting off all drooping branches. Where the trees are healthy and growing well the tendency is to throw out laterals in a downward direction

from the main branches. These should be removed, as also any growing too straight out at the sides, as when the trees get old they are inclined to spread out wide and droop. In forming the head, four main branches are usually found sufficient, giving plenty of shade, and at the same time admitting the sunlight to properly ripen the fruit. In very hot districts the fruit requires to be well shaded, and even then it is impossible to keep some of it from fermenting on hot days.

Pruning the Plum.

The general rules for pruning deciduous trees apply to the plum and prune, with this exception, that they should not be pruned in the summer; but the first three years should be entirely devoted to forming and growing a well shaped and strong tree, which will be able to carry a good quantity of fruit without bending or breaking. To accomplish this the tree will have to be well cut back and pruned similarly to the peach, except that the top does not require to be left quite so open.

As most plums bear their fruit on 2-year old wood we want to encourage the growth of fruit-spurs, and this is sometimes accomplished by letting the tree go for one season without pruning; but this method I do not particularly favour, unless the tree will not bear well without it, as it necessitates a heavy pruning the following year, which starts out too much new wood. Some varieties, however, bear so heavily that it will not be found necessary to prune every year.

Pruning the Pear.

My experience with this tree has been that it does better when pruned and allowed to grow in an upright pyramidal shape, shortening back any long growth, and keeping the tree within bounds by cutting the limbs short, so that they will be strong enough to carry the weight of the fruit; and as the fruit is inclined to grow at the end of the limbs, there is always a danger of breaking if allowed to grow too long and slender. However, there are some varieties of a drooping nature, and these should be started with a fairly high head—say 30 inches from the ground, and the leading branch or trunk staked for a year or two, or until strong enough to support its branches without bending over.

The pear will require to be kept thinned out every winter, and cross branches taken out; and I would recommend, where it does not set well, to try pruning while the tree is in bloom, as I have noticed in some of our warmer districts that although the trees may bloom well, but few pears set. Root-pruning for such cases would be advantageous.

Pruning the Peach and Nectarine.

These trees give the best results when formed with low heads, and as they make very strong growth they require very hard pruning for the first four or five years. The first year they should be cut back to three short limbs without any laterals being left on, and for the second and third years they will have to be kept well in hand, thus necessitating very heavy winter pruning, keeping the centre fairly open, and not allowing the tree to get too thick, as when too much wood is left they will not bear well, the buds never properly developing. I have found that the trees which have paid best in the end are those which have not been allowed to bear any fruit (except, may be, for the purpose of ascertaining whether trees are true to name) until after the third year, the first three years to be devoted to forming and developing the trees, which, if planted in suitable soil and of proper kinds,

will yield a good return the fourth year. Over-cropping must be strictly avoided by a judicious thinning when the fruit is well set and swelling. Leave the most promising from four to six inches apart if small, and twice that distance if large.

At the end of July or thereabouts we commence pruning. This consists of shortening in or cutting off half of the last year's growth all over the tree, and cutting out any sickly small wood that did not mature, and only leaving the strongest shoots. All strong growing limbs should be shortened to a uniform length, so as not to destroy the balance of the head. By reducing the young wood one half we reduce the coming crop one half, as the peach and nectarine always bear their fruit on 1-year old wood; thus the remaining half will be of better size and of more commercial value. These trees require regular pruning every year during their lifetime. However, when once a tree is 5 years old and upwards it does not take long to prune it, and when the operator has become accustomed to the work it is surprising the number of trees a man can get over in a day.

By removing enfeebled parts and encouraging fruitful wood a standard peach or nectarine will continue to bear large crops of excellent fruit for many years.

Just a word here to the intending planter as to kind. While the nurseryman has hundreds of different varieties of peach trees, I think one could easily count on his fingers the best commercial kinds he has; and I strongly advise buying only such kinds as are good for canning, drying and dessert. There are not many varieties which combine all these qualities; but by all means don't buy rubbish, and that is what half the varieties grown really are.

Pruning the Orange.

The orange-tree usually has its head started in the nursery from 20 to 30 inches high; but this is of little use, as when the trees are removed from the nursery, and taken to where they are to be planted out in orchard form, most of the top, if not the whole, is removed, so as to enable the tree to more quickly recover from the shock it receives in having its roots cut. After planting it is always advisable to shade the stem until the branches start growing at the top and leaves on the stem, neither of which should be removed for a while. I have found it advisable in this country to allow everything to grow the first year after planting. The second year take off the bottom shoots as high up as from 1 foot to 15 inches from the ground, and the third year form your tree by starting the head or crown about 24 inches from the ground. Even now, very little pruning is required, as the larger the top the more vigorous the root-system will be, and better able to start the tree out quickly when pruned. It is never advisable to prune a citrus tree during the winter, as it exposes it to the cold winds and sometimes frosts, both of which are very injurious to its growth and tend to stunt it. Always try to prune just before a growth, and if any rough cuts are made, trim them off smoothly with the chisel, and paint them with rubber paint or shellac and alcohol mixed to form a paint, and apply with a brush. My experience has been that the orange-tree will not thrive in this country under the same treatment as in California. There, we went in for high-headed trees, and it answered very well, as in California we get very few high winds in summer time, whilst in warmer districts in Australia seldom a fortnight passes without one or two hot dry winds, which not only scorch the trunk of the tree if exposed, but also, in sandy districts, blow the sand against the trunk, and thus damage it.

When once we have got a well balanced tree with branches evenly distributed around it, and it has started to bear, it is advisable to clean out any rubbish or small branches in the centre of the tree so that the air may get in and have a free circulation. It is then more easy to keep it free from scale, and when necessary to spray, the work can be done more effectually by enabling the person to get at the inside. If possible, prune just before the first growth in the spring. When the tree has attained any size—say about the fourth year—any laterals projecting out on the sides or top may be cut off so as to keep the tree evenly balanced and fairly compact.

The fruit-buds always come on the new growth, and by keeping the tree in a healthy growing condition by an occasional dressing of manure (stable or sheep well-rotted are preferable), it will ensure a fairly good crop of fruit every year.

Pruning the Lemon.

Pruning the lemon is very similar to pruning the orange, and they require the same treatment when planted, allowing the trunk to be well shaded without any pruning the first year, and forming the top after the second or third year; but as it grows more rapidly than the orange it will require more severe pruning. Therefore, all straggling growth will have to be cut back every year, and the tree thinned out, arranging the branches so that they will not be too close together. Cutting back the limbs in this way will so strengthen them that they will be able to hold a good crop of fruit. When the trees are kept properly pruned, they will throw out numerous short laterals, and the fruit will be borne more in the centre of the tree, so that there is little or no danger of the limbs breaking with the weight of the fruit. The best lemons are found all round the centre and bottom of the tree, where the wind does not have a chance to blow them around and damage them by rubbing against branches and thorns, as is the case with trees which are allowed to go unpruned. If it should be found necessary to remove a large limb, see that the wound is properly trimmed with the chisel, and painted with shellac and alcohol, and only prune when the tree is in a growing condition, as then wounds are quickly healed over without having time to dry out and damage the tree or limb with decay.

Pruning the Apple.

This fruit-tree while young should be formed in the manner set forth in my opening remarks on pruning, although many prefer starting it a little higher than the peach or apricot—say, 2 feet. In this case it is well to see that the limbs are started from the stem of the tree at different points, and at distances of not less than 6 inches apart, and radiating around the stem. This will give each branch a firm hold of the trunk, thus laying a good foundation for the future large tree. As it throws out fruit-spurs which are scattered well over the tree, it is well, more especially while the tree is young and growing thriftily, to pinch back the young growth several times during the summer. This will tend to make these branches throw out spurs or fruit-wood, in place of forming too many useless branches, which only have to be cut off during the winter pruning. I would, however, impress on all orchardists that the secret of fruitfulness is not to be found in fancy systems of pruning, but by keeping the heads properly thinned out, and by at first getting a good foundation of roots of the proper kind, which are not subject to all diseases, together with a well-shaped head. After once the tree has been properly formed, and when it begins to bear regular crops, very little

pruning is required, except the usual winter cleaning out of dead and worthless wood, and the removal of such as may interfere with others, or too greatly crowd up the head of the tree.

An apple-tree is much the same as other trees, and if allowed to grow at its own sweet will, will bear a heavy crop one year and very little the next. To prevent this the orchardist should thin out very nearly half the fruit while young the heavy year, and if any extra pruning is required, always do it the winter before the heavy yield is expected. This will tend to relieve the tree of some of its buds, and help develop a supply for the following year. As close pruning in winter induces growth, judicious summer pruning causes the true to throw out spurs and blossom wood; root-pruning arrests growth and promotes fruitfulness, and thinning crowded spurs and blossom buds, favours a good set of fruit.

Care must be taken not to prune apple-trees too much in very warm districts, as it has been found that, after they are once shaped, they bear better by not being severely pruned. I refer more particularly to districts in the interior.

If we wish our trees to grow and bear well, they should receive the best attention, and this includes not only good cultivation and pruning, but when bearing crops of apples they must have manure to enable them to yield good crops of best quality of fruit. Manures rich in potash, soda, and phosphoric acid are what they require the most of. They must also be kept clear of all fungus or insect diseases. This will require sprayings with different solutions to meet the different requirements.

Pruning the Cherry.

Head low in, as with other trees during the first few years. The best time for pruning is in the summer, as then there is less liability of the tree gumming. It bears from spurs chiefly, and care must be taken not to rub any of these off. Shelter the trunk as much as possible by allowing the lower buds to grow along it, but pinch these back when they have made a few inches growth. The cherry is not a very long-lived tree, but in favourable soils it generally lives from thirty to forty years if kept in a healthy state and free from insects.

Pruning the Persimmon or Japanese Date Plum.

The date plum is peculiar to China and Japan, and is highly esteemed for its fruit in both these countries, where it is grown extensively.

Young trees should be started with low heads similar to the plum and pruned the same as the latter, except that it may have a light summer pruning in cases where it is inclined to make a luxuriant growth. Older trees must have their growth regulated according to their requirements, and as the fruit is chiefly produced on 1-year old wood, it is well to thin out and shorten back every winter. Good cultivation with liberal manuring will, in warm districts, ensure good crops. This tree is propagated in the same way as any deciduous tree by first raising seedlings, and then budding or grafting at the proper times.

Pruning the Raspberry, Gooseberry, and Currant.

The raspberry requires one pruning in every year, to be given early in the spring. To perform this, examine the stools, and leave the strongest shoots or suckers—from three to five on each stool. Cut away all the old wood and

remaining suckers. The remaining shoots should have a foot taken off the ends of each, and if very long remove at least one-third. It is a good plan, as soon as the old shoot has finished fruiting, to cut it away, so as to give the new cane a better chance to ripen. Give them plenty of manure and they will repay you well in fruit.

The gooseberry requires an annual pruning. If growing at all well, fully one-half of the wood, both young and old, should be cut away, as it is impossible to produce good berries without thoroughly thinning out the branches. Fruit is always grown on young wood, so that it is advisable to leave this in preference to the old. The head should be sufficiently thinned out to admit light and air freely.

The currant should be grown in a tree shape, the first shoots leaving the main stem about 8 inches from the ground. The treatment is of the simplest kind, thinning out the superfluous wood every spring being all that is required.

[I am indebted to previous numbers of the *Agricultural Gazette* and John Wright's *Fruit-Growers' Guide*, vol. I., for some of the diagrams used for purposes of illustration.—W.J.A.]

Pruning the Vine.

M. BLUNNO,
Viticultural Expert.

By pruning the vine the grower is enabled to bend it to his industrial purpose; to secure for the next vintage a crop of grapes satisfactory as to quantity and quality of juice; and to balance the strength of the growth with the fertility—whether natural or artificial—of the soil, with the age of the vineyard, and with the climate and conditions of the district, so as to not exhaust the vigour of the plant, but to secure instead a good crop for as many years as possible.

The skilful grower, by training and shaping the stem and the rods of the vine, is able to control to some extent its physiological functions, *i.e.*, to prevent the rush of the sap in the too vigorous varieties, and in very rich soils, which leads to a growth of leaves and wood and to the abortion of many flowers, and can turn this vigour to a more profitable account by checking, in some degree, the course of the sap, whence a better elaboration of the nourishing materials will be the result, to the advantage of the crop.

By growing the vine-stem higher than usual, the vigneron may be able to avoid to some extent the effect of late frosts where this hydrometeor often occurs; by keeping the preserved canes more close, and by fastening the shoots at the time of the summer pruning, grapes can be protected from the scorching sun in very hot climates, or may hasten the ripening and secure its completion by exposing them to its beneficial effects in cool or cold districts. In the latter case more ventilation is also allowed if the country is rather rainy, so keeping a drier surrounding air, which prevents the attack of several fungoid diseases; a more active transpiration of the leaves is fulfilled, so getting a more concentrated and rich sap, and preventing the tissues from remaining too soft, and so not attaining a complete summering.

Whatever the system of pruning the vine may be, it should be based on the following general principles, which the vigneron should bear in mind like a creed from the moment he takes his secateur and saw to commence the work.

1st. The quantity of the crop is constantly in inverse proportion to that of the wooden development of the vine, *i.e.*, the more the wood the less the crop, and *vice versâ*.

2nd. For every single reserved cane, the stronger and bigger sized it is, the less will be its tendency to bear fruits. Canes of average thickness are the most fruitful.

3rd. The vertical position of any spur or rod is very much favourable to a large wooden growth and leaves, the inclined or horizontal disposing the buds to give fertile shoots; therefore any disposition or arrangement

* The matter of this article formed the subject of a lecture delivered at Albury and Corowa on 26th and 27th April last.—M.B.

directed to check the course of the sap is always the best to secure the production of bearing wood, so that bowing and bending down the reserved long rods is a very wise manner to trim the vine. Any wound, scar, knot, tie, or grips on the stem or canes of a very vigorous vine, by preventing the rush of the sap, and by somewhat weakening the plants, are propitious to give a fair advantage to the crop on the wooden growth.

Beside this the vigneron must remember that suckers, say the canes coming from the wood more than one year old, will not, as a rule, bear shoots with grapes, so that they are always to be cut off except when one or more new branches are wanted to give the vine-stem a proper shape, and equalise the growth on each side of it. In this instance a sucker is even sought and assisted to grow. When one or two of them are lowly placed they may be kept in order to lower the vine-stem which after several years since the planting may have attained a height not suitable to the adopted system of training the vines.

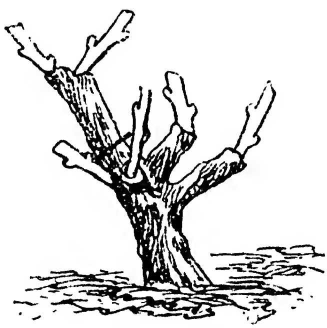


Fig 1. Showing where the old and overgrown branch should be cut off, leaving spurs for formation of new arms.

When the second year has elapsed the new arms grown out of the suckers will bear fruit, the old branches of the stem above the latter are taken away, so the plants are not only reduced to a normal height, but even renewed and strengthened owing to the suppressed old and wearied material (Fig. 1).

Time for Pruning.

In no branch of agriculture can any suggestion be taken as absolute. Variations of climate, season, soil, and influences that cannot be foreseen, make it impossible to lay down a definite routine of operations according to the calendar at hand. Every operation must be performed with due regard to all the surrounding circumstances, and acute observation is absolutely essential. It is this dependence upon intuition and experimentation according to the variability of things that makes agriculture so difficult a subject. So far as pruning is concerned, under a routine it might be specified that the work should fall on such a month in one district and such a month in another place, but in actual practice so many allowances and departures would have to be made that the rule would be reduced to but a few instances.

In those climates and soils where vineyards grow very strong, and have a plethoric wooden development, mostly, if the vines are young, the pruning should be delayed till the sap starts to move and buds swell, whereas in this case we want to get rid of an excess of humour, which leads to the inconvenience of a scarce crop in favour of the wood and foliage. By pruning later the canes which are cut off bring with them and take away that part of sap which ran into them since the vegetative movement began.

If the vineyard, owing to its exposure, is subject to late frosts, the late pruning may often save the vines from this injury, because it makes the buds shoot with a delay sometimes of a week or ten days, especially the lower eyes

which mostly are to be reserved. These being still close when the frost would fall, are not affected by the freezing temperature.

For old vines in poor or very dry soil the pruning should be earlier, so as to avoid an abundant bleeding, which would make the plants weaker.

How to cut Canes and Branches.

Very little attention is paid, as a rule, to this particular of the pruning of the vine, and I deem it advisable to give a few hints concerning it, to save several inconveniences which may follow through their neglect.

A rod should be always cut on the knot actually above the upper eye to be reserved. If you split a cane you see that the pith is interrupted by a diaphragm of hard and ligneous tissue in correspondence to each knot. It is just on this diaphragm that the cut should be made, so that protection may be afforded to the spongy tissue which the pith is made of (Fig. 2).

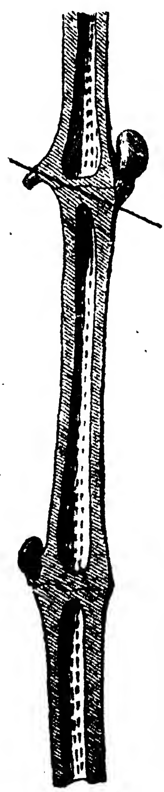


Fig. 2.—Line showing cut through ligneous diaphragm.

I know myself that this system of trimming would not give a nice appearance to the vine, on account of these stumps so being left over the last eye of the spurs; however, it is the best method. At all events you may cut the interknot just on its middle for those varieties with long *meriths, and a little higher for those which have them short.

The very common system of cutting just close to the eye is to be condemned, for the wood dries up to the distance of a few lines below the cut and the eye may be destroyed, or, at least, injured. Moreover, the cut should be made sloping, and the inclination on the opposite side of the position of the eyes, so that if the spur is vertically situated the flow of the sap may not injure them (Fig. 3).

Fig. 3.—Showing the sloping cut with inclination opposite to position of eye.

Any branches of old wood to be shortened or removed at all should be always cut close to the insertion, and always with a sloping cut, so as to hasten the healing up of the wound. For all large cuts it is advisable to use grafting wax for protection against the action of the air, but the treatment of the wound with a fungicide† solution would serve better and be more speedy.

It is evident to the slightest observation how many vines last much less time on account of a sort of dry cancer which the cuts not healed are subject

* Merithal syn. interknot.   † See note next page.

to, the cancer working below and invading a good part of the stem. To these neglected large cuts may be accounted the spreading of two vine diseases—the *malnero* and the *rogna* (French *brussin?*)—which most likely are due to bacteria that find an easier way of invasion through any lesion or unprotected tissues.

All the germs of putrefaction floating in the surrounding air, or living in the soil, find a very suitable liquid to live in in the sap bleeding from the large wounds, and then attack also the healthy tissues afterwards.

There is a very speedy way to prevent the penetration of these germs by applying to the wound the same solution as suggested for the winter dressing against the anthracnose* as soon as the cut is made.

Short or Long Pruning.

This is a vital argument intimately connected with the economical success of the vine-growing, and vignerons are so alive to the importance of it that I am often asked about this subject. But before going into the matter I would request you to follow me in a short digression of nomenclature, and some other general information.

For short pruning we shall intend a system of cutting the rods to be reserved on the vine, from one to three or four eyes, beyond that the method begins to be of long pruning. The stumps of one-year-old cane cut back to two eyes are generally called spurs. When they are associated with rods of six to eight or nine eyes, then a mixed pruning will ensue.

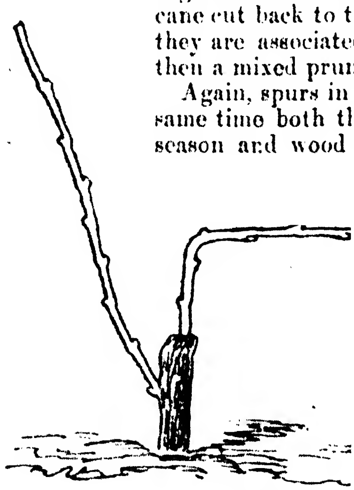


Fig. 4.

Again, spurs in the system of short pruning play at the same time both the parts of giving fruits for the current season and wood for the next. In the case of pure long pruning one or two spurs are at times left, but while the production of the grapes is entrusted to the rods left long, the spurs are instead meant to give only the wood for the pruning of the next season, so that we do not look whether these spurs are more or less well placed to bear many fruits, but we care more for their position on the stem being such as to supply us with good shoots strong and well implanted so as to become at the end of the season well summered canes for the pruning of the next year. Still, you can induce a simple bud to fill the part of spur. Suppose that

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* Concentrated solution of sulphate of iron :—

Sulphate of iron (green copperas), 5 lb.
Sulphuric acid (oil of vitriol), ½ pint.
Warm water, 1 gallon.

To avoid the spurting of the acid over the face and hands of the operator in preparing the solution, the suphuric acid should first be poured over the sulphate of iron, and afterwards warm water added.

when stretching the long cane along the wire you make the fold a little above the first or second bud, and give to those interknots, upon which these buds are placed, a vertical position, you will find that owing to their position being just on the direction of the flush of the sap, the same will develop in strong shoots, which, as a rule, will not bear fruit, or very little, but will become very strong canes of replacement for the next year, whilst the eyes placed on that part of the rod in a horizontal position, because of the sap checked at the fold, will develop in shoots not so strong, but will give plenty of grapes in compensation. (See Fig. 4, right hand cane.)

The unsuitability of the short pruning for some kinds of vines is well-known, as for instance the currants, while some others do well enough. The higher percentage of sugar in the must of short pruned vines is commonly admitted. But here there is hidden a question of viticultural economy that I wish to make plain. Some varieties without being unadapted to a short cut would pay far better, in my opinion, if pruned longer. The adoption of the long pruning for the Shiraz has proved a success also in these colonies, and I am sure it will be the same for some other grapes—for the Malbeck, to give one instance. As far as the Cabernet is concerned you know that to get a crop you must give it a long cut.

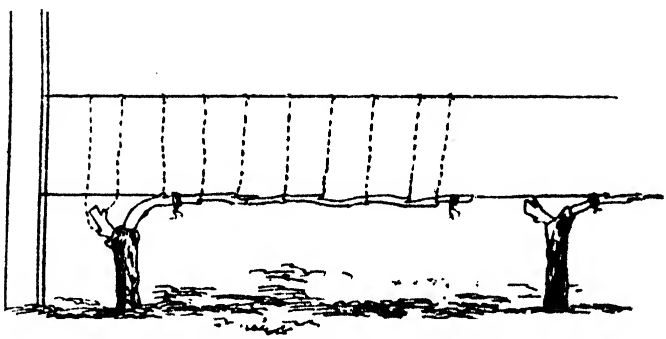


Fig. 5.—System named after Dr. Guyot (simple).

One objection might be raised from the part of those who believe only in musts with the highest specific gravity. A long pruning will give as a rule a heavier crop, but sometimes with a percentage of sugar a little lower, and a higher degree of fixed acidity. Well, from the point of view of a good and complete fermentation a too high specific gravity is other than a blessing; moreover these probable differences are very often most trifling.

I know that many of you go for those red full-bodied wines which in Australia are called Burgundy, and you think perhaps that the heavier crop may weaken the must to such an extent that the making of the above-mentioned kind would be no more possible. It is not so; you can make it all the same, one degree of sugar less will not change the type.

There is at present in the European wine districts a very favourable movement for transforming the old classic gooseberry-bush system of pruning into that either of the horizontal cordon on single arm with spurs, or any other method which would allow of one, two, or more long canes being left to each vine, the aim being to increase the quantity of the crop without prejudicing the quality. Now, more than ever, the European vignerons feel the imperative necessity of having the wine at the lowest cost

price, to stand the competition which every day is becoming keener on the markets of the Continent, owing to viticulture holding a foot in other countries, which not only have ceased to be importers but threaten to become exporters of wine. Moreover the increased expenses for combating the different new diseases affecting the vines must find a refund of money in the increased yield through a more rational system of cultivation.

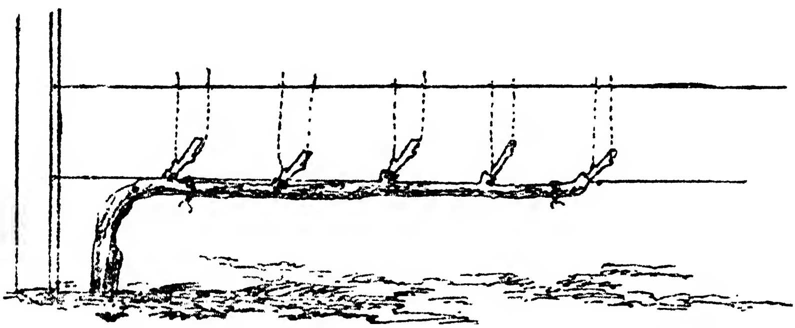


Fig. 6.—Horizontal cordon; unilateral, simple; also called Royat's system.

In Australia, one of the drawbacks to a more popular consumption of wine is that this beverage is found too dear. If we could produce the same classes of wine at a lower and popular price, it would attract more consumers, and pay the vignerons and the wine merchants far better.

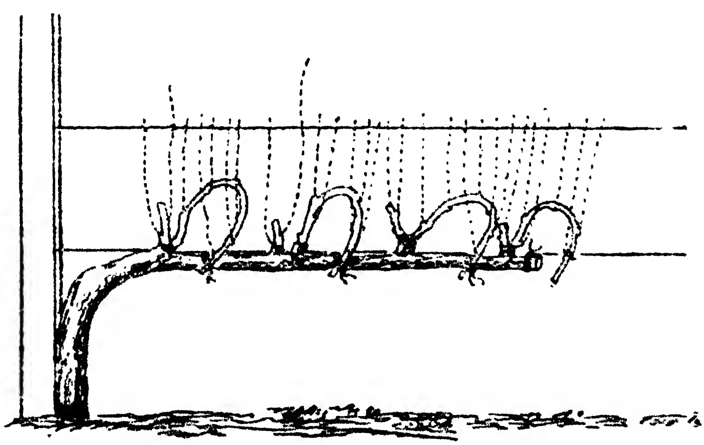


Fig. 7.—System of Cazenave, modified by Guyot.

The wine should cease to be considered a luxury and become, I would say, more democratic, without of course excluding some brands made in privileged conditions for that class of people who may indulge themselves with high-class and high-priced wines.

Selection of the proper kind of grapes, of soil, rational pruning, and other cares of cultivation, and a right making, are the factors of the complex problem.

To show you what difference can be made in the yield by a good method of pruning, I shall quote from some large experiments carried out in different places on the Continent, at one of which I was a personal witness and actor.

It is needless to add that the experiments have been protracted for a length of years, and always conducted under the most reliable conditions.

Four systems were put to trial, viz:—

1. The common gooseberry-bush method.
2. The Guyot pruning, which consists of a rod with 6–7–8 eyes, stretched in a horizontal position, and a spur with two eyes to give the necessary canes for the pruning of the next year. (Fig. 5.)
3. Horizontal cordons on a single arm with spurs. (Fig. 6.)
4. The system of Cazenave-Guyot, consisting of a single horizontal cordon, on which are implanted spurs of two eyes associated with canes of 6 to 7 eyes. (Fig. 7.)

The average number of eyes left was equal through all the systems in experiment, the soil quite the same throughout all the plot, say, loose, deep, fresh, and fertile, the same attention as to cultivation was paid, &c., so the only difference consisted in the training of the vine.

The kinds of grape first tried were the Cabernet and the Sirah (synonym of Shiraz); the following having been respectively the quantity of the crop per acre, its strength in saccharine matter, and the fixed acidity:—

Sirah.

Quantity of crop.	Percentage of sugar.	Percentage of fixed acidity.
1st system, 2,130 kilos.*	19·42	1·053
2nd ,, 3,333 ,,	18·88	1·057
3rd ,, 4,780 ,,	19·42	1·020
4th ,, 6,080 ,,	19·08	1·046

Cabernet.

Quantity of crop.	Percentage of sugar.	Percentage of fixed acidity.
1st system, 2,330 kilos.	18·58	1·012
2nd ,, 3,221 ,,	18·38	1·027
3rd ,, 4,700 ,,	18·88	1·020
4th ,, 6,851 ,,	17·10	1·012

* A kilo = a little over 35 oz. avoir.

The percentage of sugar does not compare favourably with that we have here, but remember that these experiments have been carried out in a place where the musts, as a rule, never attain a higher standard than 21 to 22 per cent., owing to the climate of the district, which is rather cool and rainy. Therefore, the figures given do not lose their meaning when the question is regarded from a general standpoint. What really is of interest to us is the very trifling difference amongst the four systems for both the percentage of sugar and fixed acidity. For the Cabernet only, as you see, there is a difference of 1·78 per cent. of sugar between the third and fourth systems in favour of the former. The crops in the four systems adopted are in the same proportion than the numbers 1: 1·67: 2·25: 3 for the Sirah, and as 1: 1·38: 2·01: 3 for the Cabernet.

Perhaps you may argue on the point that both these kinds of grapes have a preference for the long pruning, and the said preference would account for the larger crop. Then I call your attention to the fact that even with the third system, namely, of the horizontal cordon with spurs, the yield is more than twice than that got from the gooseberry-bush training, and you know that the horizontal cordon with spurs is to be considered as short pruning.

Beside this I may quote from experiments which concern kinds of grape that in their districts of origin are indifferently pruned short or long, and the

crops stand respectively like the numbers 1: 1·62: 2·83: 4·12, as you may calculate by yourself with the figures given in the following plans of M. Carlucci :—

Kinds of grape.	Gooseberry-bush system. 1	Guyot system. 2	Cordons. 3	Cazenave-Guyot system. 4
Malbeck	1·470	2·575	3·600	6·750
Meunier	0·433	0·380	1·200	1·250
Merlot	1·300	2·500	3·750	5·250
White Pinot	0·430	0·933	2·750	2·850
Grey Pinot	0·930	1·550	2·950	2·900
Muscatelle	1·400	1·675	3·850	
White Gamay...	0·700	1·500	1·500	4·625
White Traminer	0·600	0·400	1·325	3·000
Riesling	0·750	1·430	2·025	3·250
Italic Riesling...	1·020	1·733	2·655	3·650
Average, per vine	0·903	1·467	2·558	3·725
Proportion	1·00	1·62	2·83	4·12

I am following with great interest the correspondenceof French vignerons to the Editor of the *Revue de Viticulture*, which put the question of pruning before them, to know from those who have tried what was their experience with the different systems. It is plain that the answers are very disparate, which is accounted for through the quite different conditions of all of them ; but I see that the system of horizontal cordons in many places is gaining new partisans every day, and nothwithstanding this method is to be considered, as I have said, a short pruning, it has such an advantage on

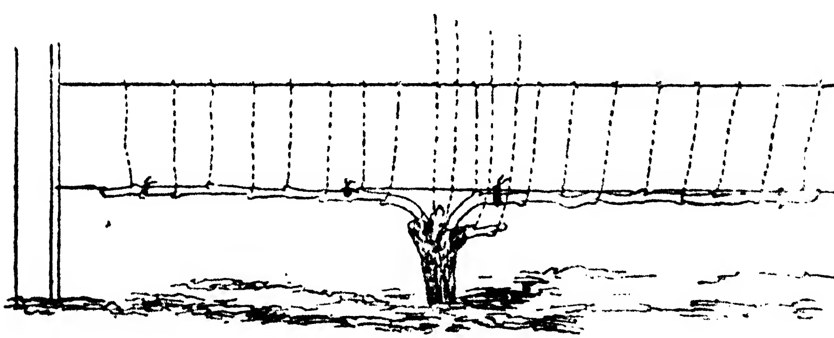


Fig. 8.—Double Guyot.

the common gooseberry-bush fashion as to give more than twice the crop, and still keep quite the same standard of the saccharine strength. It seems the vine, when shaped in horizontal cordon, is more favourably disposed to give plenty of fruits.

For the climate of the southern vine-growing districts, where the rain is so scarce, I discard the fourth system, viz., the Cazenave-Guyot, as it requires the possibility in the vine of a too vigorous growth, which, as a rule, is impossible in very dry soils.

The cordons themselves are more suitable in districts where the vine can find enough moisture for bringing to ripeness the larger crop, and securing

at the same time good canes for the pruning of the next year, and if any of you are going to try them, I would suggest to go for simple cordons, say, not with double arms (Fig. 9), so as not to push and force the vigor of the plants, because after few very good vintages he would complain of an ever decreasing yield, owing to the exhaustion of the vines. Deeper and more frequent working of the soil and proper manures should help the vineyard to continue its generosity for many years.

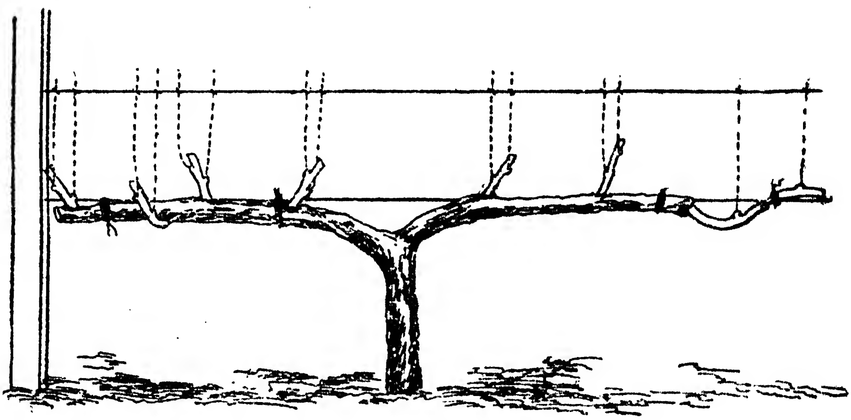


Fig. 9.—Bilateral, Horizontal Cordon.

Then comes the Guyot system, which, you know, consists of a long rod with six to eight buds, the rod being renewed every year through the canes coming from a spur left for this purpose. The yield is generally considered with respect to that of the gooseberry-bush fashion in the average proportion of 1·5 to 1. The said system is not so exhausting as the cordons and the Cazenave's, so the need of manures is not so felt as in those two cases. But if you adopt the so-called double-Guyot method (Fig. 8), as you will have an increase of the crop on that of the simple Guyot, more frequent labour is needed, and from time to time, say, every two or three years, you should give back to the soil what the heavier crop has taken away, and also restore to the vines what is taken from them by a more abundant fructification.

Fig. 10.—Gooseberry bush, with long rod called in some districts of France *Flèche* or *Pissevin*, and in Sicily *Scaricaturo*.

Bear in mind that I do not exclude deep working and, from time to time, proper manuring for the vines pruned on the gooseberry-bush system, especially when to the spurs is associated a long rod (Fig. 10); I mean to say that attention to the land, and the refund to the soil of the nourishing elements taken away by the vines, must be more for the vineyards trained

on the system of pruning, which cause the vines to be more heavy bearers. It is only a question of proportion.

When a long cane is left with the spurs on a vine trained on gooseberry-bush fashion of very strong wooden growth, care should be taken every year, at the time of pruning, not to leave this long cane always on the same branch, but a new arm should be charged to support it. This is necessary in order to equalise growth on all sides of the vine, which would otherwise become contorted.

From what you see of the systems of horizontal cordons, Cazenave-Guyot, and simple Guyot, there is the necessity of a special fitting of stakes, and of two wires stretched along the rows, which, beside the increase of the expense for the outlet, is also the cause that the vineyard cannot be ploughed across, requiring, therefore, more hand-labour to work those strips of ground left along every row. This is somewhat a drawback of the above-mentioned systems, but all having been calculated they have resulted more payable than the gooseberry-bush method. For me, I am not in doubt in stating that in the southern districts the Guyot system, either simple or double, would be found very advantageous; also the horizontal cordons would prove very profitable, especially in land with subsoil capable to retain the moisture, that is essentially necessary in all systems, which causes the vines of a stronger growth, and in any system some moisture is more essentially, the more the shoots grow removed from the main stem.

Now to conclude: I would again impress the necessity of studying the different questions of viticultural economy, in which resides the future of this young colonial industry, and the pruning is one of the more complex problems. Do not get simply satisfied with the notion that both climate and soils of a very large zone in Australia are very suitable to grow the vine, and make wines very good too. There is no mistake about that. For the suitability of the soil and of the climate you do not deserve any merit, for they are natural factors; the merit deserved by you will start where you begin to show how you can take the best advantage and the best profit from these natural conditions.

[I am indebted to M. Foëx's *Cours de Viticulture* for figures 2, 3, and 10.]

The Fruit-maggot Fly.

* (*Tephritis Tryoni, n. sp.*)

W. W. FROGGATT,
Government Entomologist.

THE fruit-maggot fly bids fair to become one of the most destructive pests that the fruit-growers of New South Wales will have to deal with, for during the present season it has appeared in all parts of the country, increasing with such rapidity that in many of the northern districts all the late fruit has been destroyed.

As these flies breed all through the season, where they appeared early the first flies infected the first peaches and apricots, the maggots from these producing a second brood of flies, ready to attack the late peaches, apples, quinces, &c., while a third generation are now feeding upon the guavas and persimmons. At the Inverell show last month Mr. Stephenson called attention to the state of the apples in that district, and stated that he had not seen a sound one in the place. Through his report a number of samples were forwarded to the Entomological Branch, where they are now under observation, and it is thought the following notes may be of interest to fruitgrowers.

The first maggoty fruit received this season was forwarded by Mr. T. T. Wingfield, of Tenterfield, early in February, from which were bred about a dozen of these flies towards the end of the month. On the 9th April some late peaches, swarming with well-developed maggots, were sent in by Mr. J. Hollier from Penrith, while about Gosford they have been reported as doing a great deal of damage during the last three months.

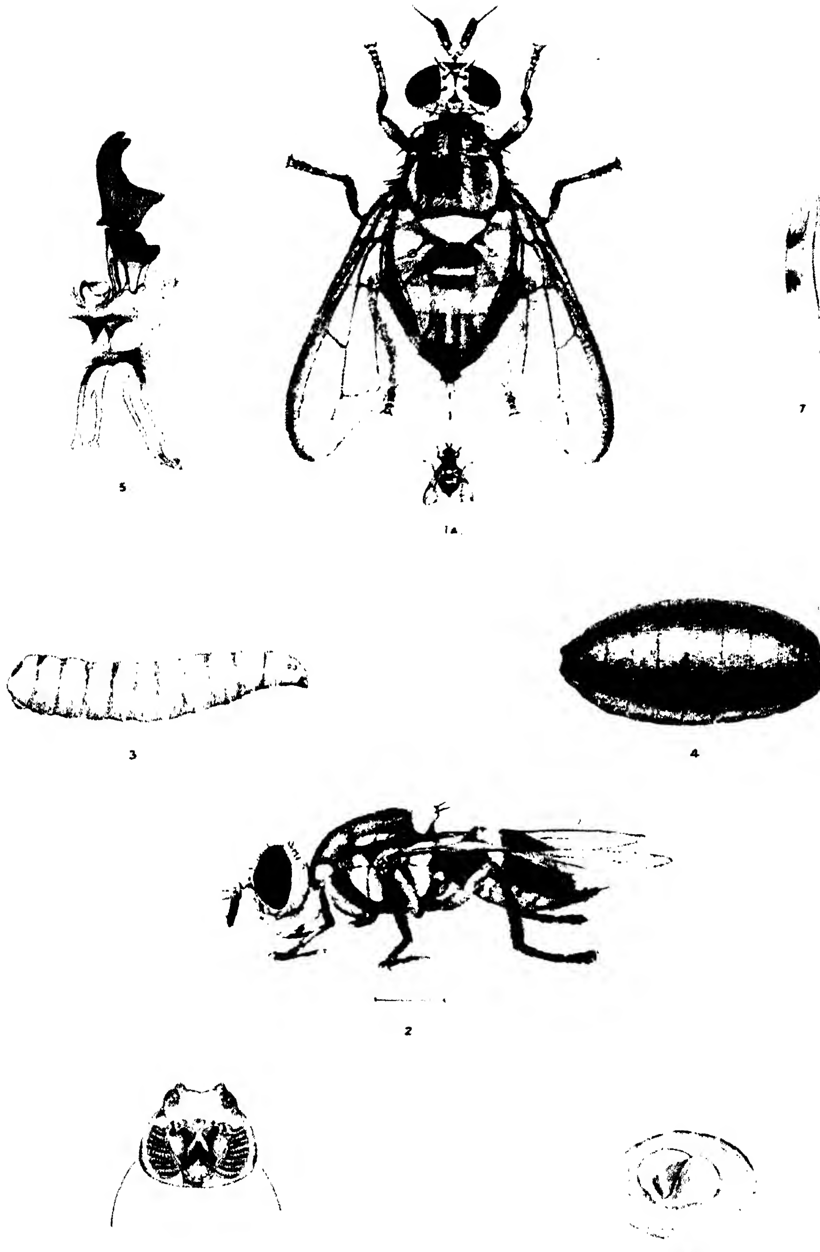
Mr. McKeown, manager of the Wollongbar Experiment Farm, on the Richmond River, informs me that for the first time they attacked all the early fruit in that district this season, and the last brood of maggots are now finishing up the last of his guavas and persimmons. In other years previously they had never appeared till late in the season, and the early fruit escaped their attacks.

The flies were noticed by me on the 17th of May, during my late visit to the Wollongbar farm, on every orange-tree that bore fruit, and several just changing colour were found to be punctured by the flies, and contained maggots between the rind and pulp of the fruit. Several of these flies were captured, and appear to be a darker variety than those bred in the office.

General Appearance of Fruit Attacked.

When the eggs are deposited in the fruit before it is ripe, which is often the case (the time chosen seeming to be just when the fruit is changing colour), it shows very slight outward evidence of disease, but when ripening

* I propose the specific name of *Tryoni* for this fly, as Mr. Henry Tryon, who has done so much in connection with it, but has never given it specific rank, informs me that the fly is of an undertermined species.



QUEENSLAND FRUIT-FLY, *Tephritis tryoni*, n. sp.

1. Perfect Fly viewed from above.
1A. Perfect Fly (Natural Size).
2. Perfect Fly, Side View (Much Enlarged).
3. Larva, × 6.
4. Pupa, × 7.
5. Showing Mouth Parts (Co Hooks) of Larva, × 56.
6. Mouth Parts, viewed from beneath, Hooks (No. 5) showing in the centre, × 56.
7. Anal Segment, × 27.
8. Tubercule on Under-surface of Anal Segment, × 50.

shows darker spots where the skin has been pierced by the ovipositor of the flies. As the newly-hatched maggots begin to feed they gnaw irregular passages towards the centre of the fruit, and in the case of apples, quinces, and other core-fruit soon reduce that portion surrounding the core into a rotten mass, which, when opened out, is seen to contain a number of pale-coloured maggots. In the case of peaches, apricots, and stone-fruit, though, the maggots feed inwards, the whole of the side first attacked soon begins to decay.

The maggots are semi-transparent when about a quarter grown, with the head portion slender, the body thickening towards the extremity, and sharply rounded at the tip. With an ordinary lens they can be easily identified from codling moth or any other fruit grub by the general elongated form, the two curious black hooks at the mouth, and a pair of cephalic spiracles, tinged with yellow at the opening at the back of the head, which stand out very distinctly. Their mode of progression is by crawling, but though without legs, when placed upon a smooth surface, by arching up their backs and drawing the tip of the body down to the head, they can, with a sudden jerk, jump a considerable distance in a similar manner to the jumpers in cheese.

They live in the fruit until it is perfectly putrid, and when full-grown are of a dull yellow colour, measuring about half an inch in length. At this stage they crawl out of the fruit and bury themselves in the earth just beneath the surface, and transform into elongate oval brown pupæ, enclosed in a brown hard shell, like those of the house fly so common in stables.

The flies vary somewhat in size in the sexes, the female fly, as is often the case in insects, being considerably larger than the male, with the body more robust, and produced at the tip into a needle-like ovipositor, with which she does all the damage. She measures nearly half-an-inch across the expended wings, which are semi-transparent except along the front nervure, with an oblique clouded line near the shoulder. The head is broad, with large reddish-brown eyes; the antennæ yellow, with the third joint long, tipped with a bristle; the thorax is stout, of a dull yellowish-brown colour, with a few long hairs on the side, and a bright yellow patch on each side, and another over the scutellum, at the junction with the body: the latter constricted at the base, swelling out in the centre, and tapering again to the tip; it is of a general dark reddish-brown colour, showing a very distinct transverse yellow band across the upper half of the abdomen.

Remedies.—The only way to check the spread of this pest is for all fruit-growers to be on the watch and examine and destroy all fruit found to contain these maggots, while all fallen fruit should be gathered up and destroyed. As the maggots do not leave the fruit the moment it drops, as the codlin moth caterpillar does, there is a much better chance of killing most of them in this stage. Lime, or some caustic top-dressing, could be spread under infested trees, the surface of the soil having been first raked over, and if this was done a few days before the dressing the magpies and other wild birds, as well as the farmyard fowls, would make short work of a great number.

General Account.

This insect was well known as the Queensland Fruit-fly as far back in that colony as 1878, when specimens found attacking oranges were sent to the Assistant Director of the Royal Gardens at Kew, and referred to Mr. R. McLachlan, F.E.S., for report. Ten years later, Mr. Henry Tryon, when reporting upon the "Insect and Fungus Pests," found them attacking all kinds of fruit in the Toowoomba district, where the fruit-crop has been

greatly damaged. As yet the southern parts of this Colony and Victoria are free from this pest, but unless stringent measures are taken it is only a matter of time before it spreads all over Australia, and, like the cattle-tick, seems to be steadily advancing from the north. It has been known for some years as far south as Sydney, but some favourable climatic conditions have evidently helped it along during the last two years.

The fruit-fly *Halterophora capitata Weidm*, recently reported from Western Australia as doing a great deal of damage in the orchards is a very different insect from our species; it is much smaller and darker in colour, with clouded lines and marks across the wings, and, as Macleay notes:—"The male is most remarkable from an entomological point of view for having two clavate subarticulate horns planted between the eyes, so as to make the insect appear provided with two anomalous antennæ in addition to the regular pair. The female is without these singular appendages."

This fruit-fly was described by Wiedman as far back as 1826 under the name *Tephritis capitata.* Three years later, in a letter to the Editor of the *Zoological Journal*, accompanied by a very fine coloured plate of the fly, W. S. Macleay sent a very interesting account of this insect, under the name *Ceratitis citriperda.* He said that for the last few years more than a third of the oranges sent from the Azores were found to be unsound when they reached the London markets, caused by the presence of these maggots. In *Insect Life*, 1890, this fly is described and figured as "a peach pest in Bermuda," in which island it has been so destructive that all the peach orchards have been destroyed. In the *Gardener's Chronicle*, 1890, the Rev. H. Henslow gave an account of this insect in Malta, where it has been known as a very destructive pest for the past fifteen years, but confining its attention to the oranges.

Thus we now have, on our western seaboard, another fruit-fly quite as destructive as the northern species which, as it is common in the Mediterranean ports, could be very easily introduced into New South Wales by the mail boats or fruit imported from abroad, without coming round from Western Australia. So that not only have we one destructive fruit-fly with us, but are liable to the introduction of another quite as bad.

Our Queensland fruit-fly is, I believe, an undescribed species, which Mr. H. Tryon (Government Entomologist for Queensland) is going to give specific rank in a paper he has written on this pest.

Note by Dr. Cobb on the Fruit-fly, or so-called "Queensland Fruit-fly."

The fruit-fly attacks principally peaches, apricots, plums, nectarines, apples, and pears, though other sorts are not exempt.

The injured fruit may be known by the following appearances: Although it retains its form, there appears under the skin, at one or more places, a discolouration as if the flesh had turned watery, and had become somewhat decayed. On opening the fruit it is found to be honeycombed and rotten at the centre, and the dirty-brown, often semi-liquid flesh, contains one or more fly-blows or maggots, which are never quite so large as those of the common blow-fly, but otherwise to the ordinary observer much the same. These appearances are seen only in ripening fruit. The fly does not attack green fruit. A small pore in the skin of the fruit is often seen near the centre of the watery-looking discolouration.

The fly—*i.e.*, the adult winged insect—is seldom seen even in orchards where it is very prevalent, in which respect this pest resembles the codlin moth, though not for the same reason.

The female fly lays her egg under the skin of the fruit, and this is the reason that the insect is so hard to combat. The egg of the codlin moth, being laid in the eye of the apple, the grub, when it hatches, has to eat its way into the apple; consequently, if the apple be sprayed with Paris-green, the young codlin moth grub getting a bite of it is poisoned, and thus got rid of. The grub of the fruit-fly, however, hatching as it does inside the fruit, cannot be poisoned in the same manner as that of the codlin moth.

The grub of the fruit-fly requires about three weeks to develop, so that a number of broods follow each other each season. This fact will account for the great number of the grubs to be found in some Queensland orchards.

There is no climatic reason why the Queensland fruit-fly and other fruit-flies—for there are a number of species whose life-histories are much alike—should not thrive in the county of Cumberland, and do as great damage as they are well known to do elsewhere.

The common small brown fly that attacks decaying fruit in swarms should not be confounded with the pestiferous fruit-fly. This common little brown swarming fly thrives only on decaying or fermenting fruit.

Remedies.

These must be directed toward destroying and warding off the fly in all its stages. Spraying is useless. Constant vigilance is absolutely necessary if the pest is to be got rid of where it has once become well established.

1. Destroy all infested fruit as fast as it is found. Boil it for the pigs or poultry or other stock.

2. Cultivate the ground under the trees frequently. The grub leaves the fruit and goes into the ground to propagate before changing into a fly. It goes in only a little way, and cultivation is likely to so disturb it (*i.e.*, bury it or bring it up into the sunshine, where birds also can pick it up), that its death ensues before it can come forth to propagate.

3. The ground under the trees can be poisoned with kerosene and a variety of other substances that are fatal to the grubs and pupæ.

4. Poultry are said to pick up the flies and grubs to a certain extent, but the evidence on this head seems to me not very satisfactory.

5. Trees have been covered with a very fine meshed netting for a month before the fruit is ripe, and the flies have thus been kept off the fruit.

6. Undoubtedly, the most effective way to fight this pest would be by concerted action under the administration of the Government. There is now nothing to prevent infested fruit being sent from one part of the Colony to another, and thus spreading the pest at a rapid rate. If the Minister for Agriculture had power to inspect and condemn and destroy in the Sydney market alone, any such diseased fruit, it would put a strong check on the spread of the pest.

7. Any one who takes any of the above precautions should induce as many as possible of his fruit-growing neighbours to adopt them also.

8. In their own interests fruit merchants might reasonably refuse to buy fruit from orchards or districts where the fly is known to be prevalent. Fruit in store and in market should be picked over and the infested part removed and destroyed.

9. Various attempts have been made by hanging in the fruit-trees substances having an obnoxious odour to drive away the flies—not, however, with much success.

10. A remedy I have myself conceived (of course it may also have been thought of by others) is to trap the flies with fruit. If when the fruit is picked for market a tree with tempting fruit be left near the middle of the orchard, all the flies will resort to it as the only place to deposit eggs. In due time the destruction of all the fruit of this tree, and a careful treatment of the ground underneath, would put a great check on the number of flies. I believe this idea may be capable of development into the most economical and effective means of fighting this pest. It would not be necessary that the fruit should be displayed on the tree alone; it might also, after plucking, be so placed as to form an effective "bait," the idea being to attract a large number of flies into comparatively a small quantity of fruit where they could be easily destroyed. Comparatively useless fruit might be utilised for this purpose.

The City Abattoirs,—Who should erect them, and where they should be erected.

A. BRUCE,
Chief Inspector of Stock.

1. *The Corporation of Sydney should construct and manage the Abattoirs.*

SEEING that the Flemington sale-yards belong to and are under the control and management of the Corporation of the City of Sydney, it naturally follows, I think, that the Abattoirs should also be so; and, in adopting this course, it would be only doing what is the rule in almost every civilised country in the world, that the Municipal authorities should have the control and management of the markets, and Abattoirs from which the supply of animal food for the citizens is obtained.

2. *It would pay the Corporation to erect Abattoirs.*

A good deal has been said about the heavy expense which would be incurred by the Corporation were they to undertake the erection of Abattoirs, including, as they would, extensive slaughter-houses, yards, paddocks, and chilling-rooms, and providing machinery and appliances for slaughtering the stock and cooling the meat, as well as for turning the bi-products to account; and fears have been expressed that if the Corporation were to erect the Abattoirs they would land the Corporation in a heavy annual loss; but if the slaughter-houses were built as they principally ought to be, of wood and iron (as slaughter-houses at the larger meat-works throughout the Colonies now generally are), it is believed that the cost and expense of thoroughly-equipped Abattoirs, with the necessary appurtenances and appliances sufficient for the requirements of the City of Sydney, the suburbs, and the other towns in the county of Cumberland, would not be so very great, and that such Abattoirs would give a fair annual return for the outlay over and above working expenses without oppressing those using them. This statement is made on the estimate marked "A," appended to this paper, of the first cost of the Abattoirs, &c., their annual receipts and expenditure, kindly furnished by Mr. T. H. Houghton, A.M.I.C.E. & M.I.M.E., which shows, after paying working expenses, and allowing for interest and sinking fund, a credit balance of £500.

3. *The Abattoirs should be at or near the Sale-yards.*

The slaughter-houses in the United States, in many of the principal towns in the United Kingdom, and on the continent of Europe, are in close proximity to the sale-yards, and the stock are safely and quickly transferred from the saleyards to those attached to the slaughter-houses, with little or no expense to the purchasers, and no inconvenience or risk whatever to the public through driving, as is done in this Colony, mobs of wild cattle and thousands of sheep from Flemington, along the roads and streets of our western suburbs, to the waiting-paddocks between Flemington and the Abattoirs.

4. *Accommodation and Food for Stock at the Abattoirs, instead of keeping them in the starving-paddocks.*

As a rule, the stock in the sale-yards have been one, two, and even three days without food, and on being sold are turned out of the yards weary, hungry, and footsore, and often dogged and rushed along the hard roads to the starving-paddocks. There they are usually kept without any food for three or four days before being taken to the Abattoirs, and there again they can be kept for forty-eight hours longer without food, till their turn comes to be slaughtered, making in the aggregate some eight days without any food whatever. Instead of continuing this barbarous, wasteful treatment, dry, properly arranged and covered yards, or sheltered well-drained paddocks should be provided at or near the Abattoirs, to which stock on leaving the sale-yards should be taken direct; and both in the yards and paddocks there should be properly-constructed racks, in which the person in charge of the Abattoirs should see that a moderate ration of good lucerne hay, say 7 lb., was placed twice a day for each head of cattle, and, say 1½ lb., for each sheep, while the stock should have an ample supply of good clean water.

The cruel farce which is now perpetrated of sending large numbers of stock (during last year over 60,624 bullocks, a large number of calves, 11,798 cows, and over 1,159,000 sheep were killed at the Abattoirs on Glebe Island) to the waiting paddocks between Flemington and Glebe Island, under the pretence that they were sent there for pasture, where there was actually not a bite—should come to an end; for if the moderate daily rations (which is here proposed to be allowed, and which would, with hay at £3 per ton, cost, say, 4½d. per head of cattle per day, and 1d. per sheep) were given, not only would the starvation to which the stock are now subjected cease, but their owners would be in pocket, as that amount of feed would enable the stock to maintain their condition, and thus save the very heavy loss now going on through the great waste in the weight and condition of the stock from starvation.

As the trade is now conducted, the shrinkage in weight in cattle must amount to at least 8 lb. per day, and that at 1¼d. (it is the very best of the meat that goes first) would make a loss of 10d. at least in the case of cattle, and say 1 lb. in sheep, which, at 1¼d. per lb., would be that amount per sheep.

This estimate, which is well within the mark, shows that the owner would save 5½d. per head of cattle per day, and ¼d. per sheep, by giving them a moderate ration of hay. As the butcher does not take this course, the inference is that he buys the stock at a figure that admits of his allowing this waste to go on; and that, therefore, the loss arising from the starvation falls upon the breeder of the stock, and not on the butcher.

I am glad to be able to say that I have had the assertion which I here make that it pays the owner of stock intended for slaughter to give a fair ration of food, such as I have mentioned, confirmed by an authority, on whom our stock-owners and the public fully rely. Mr. Gee, of the Sydney Meat Preserving Works, shows his good sense and humanity by regularly supplying the stock he purchases with a ration of hay till their turn comes to be killed; and he assures me it pays him to do so.

Those engaged in the trade in the United States have long ago found how this question stands, for they make no objection to the law in force there, that no animal shall go twenty-four hours without food and water; and this applies even to stock on the trains, which must either be fed and watered every twenty-four hours in the trucks, or turned out for the purpose and retrucked.

Objection will no doubt be taken to the proposal to provide hay and water for the stock in the yards and paddocks at the slaughter-yards, on the ground that they would not eat hay. But Mr. Gee's experience completely refutes this objection, for instead of refusing to eat the hay given them, they very soon run to meet the dray with the fodder on its entering the paddock, and keep with it as the hay is dropped on the ground. It stands to reason that if only one beast in the yard or paddock begins to eat all the others will quickly follow the example thus set them. And when we see cattle through sheer starvation stripping off and eating the stringybark in the waiting-paddocks, it is absurd to suppose they would refuse good lucerne hay, especially if, as it ought to be, it is comparatively fresh and green. At any rate the question would be quickly settled if the owners of the stock would put some good green lucerne hay down to the cattle in the yards or paddocks; and the Society for the Prevention of Cruelty to Animals might perhaps insist that such a test should be made, for, apart from every other consideration, the terrible suffering to which the poor animals are now subjected through starvation should be prevented.

5. *Transport and distribution of the Meat and Bi-products.*

The site of the Abattoirs should be such as would admit of the prompt and regular delivery of the meat at the wholesale meat market, at the depôts of the carcass butcher, and where necessary at the shops of the retail butchers, and of the economical transport of the heavy bi-products to their destination, and, if possible, by water-carriage.

6. *Refrigerating Rooms.*

It will be observed that it is proposed to add chilling-rooms, at a cost of £14,000, to the Abattoirs. No meat should be allowed to leave the Abattoirs without being chilled, for two very important reasons:—

(1.) Chilling tends largely in warm weather to preserve the meat from taint; and

(2.) Subjected to this process the meat can be kept till it is matured, and tender and ripe to eat.

Anyone can see the importance of the first advantage, as it would be the means of annually saving thousands of pounds; and there is no one who will not appreciate the second, when he recollects how very often in summer-time he has had to eat meat which the animal-heat had not left when it was put on the fire to cook, and which, of course, turned out tough and indigestible.

7. *The best site for the Abattoirs.*

The best site for the Metropolitan Abattoirs, considering the position of the sale-yards, and the other circumstances as they now exist, is, I think, the land on the Wentworth Estate, on the same creek as the Sydney Meat Preserving Company's works at Auburn, and I make this suggestion for the following among other reasons:—

(1.) By adopting that site the inconvenience and nuisance, whatever that may be, which now arises from the two separate slaughter-houses on Glebe Island and at Auburn, would be confined to one locality, and to a locality which is comparatively isolated and already devoted to the meat trade; for not only are the Sydney Meat Preserving Company's works on Haslam's Creek, a little to the north of Auburn, but the Stockowner's Meat Company of New South Wales are erecting large works, at no great distance, on the Parramatta River; and as the prosperity and progress of the Colony are too much dependent upon the business done by these Companies to permit of

their being unnecessarily interfered with, there is no risk of their being called upon to remove, even if there were any agitation, which there is not in that direction; and it may be taken for granted that the locality will be permanently devoted to the meat trade, for which, it will afterwards be shown, it is well adapted.

(2.) As to the inconvenience and nuisance which these works and the Abattoirs would occasion,—now that the desiccating machinery and appliances for dealing with the offal of slaughter-houses have of late years been so greatly improved,—there is not the least doubt but these works and the Abattoirs can be conducted without being an inconvenience or nuisance to any one unconnected with the works beyond that of the stock, at certain stated hours (late in the afternoon and evening), having on sale days to be driven on the Parramatta road, between the sale-yards and the Abattoirs for less than 2 miles.

With respect again to the nuisance arising from the slaughtering of the stock, there will be a considerable population connected with the works and the Abattoirs residing around them who would not, if the works were properly constructed and conducted, consider them a nuisance, and would, of course, make no complaint, while outside the houses of those connected with the works, and scarcely in all of them, no inconvenience or nuisance need be felt.

(3.) It is not likely, therefore, that any objections would be raised to the erection of the proposed Abattoirs near the Company's works; for the slaughtering of the additional stock would not add to the risk of a greater nuisance being created, but would rather, through the combined action on the part of the City Council and the directors of these companies, tend to the perfecting of the present arrangements for dealing with offal as well as to making the drainage more complete, and carefully removing any trace of blood from the water entering the drains.

(4.) The proposed site would, so far as the delivery and distribution of the meat and the transport of the bi-products are concerned be well adapted for the purpose. The Abattoirs would, of course, have to be connected with the main and suburban lines of railway; and that, it is believed, could be fully and economically effected by arranging with the Sydney Meat Preserving Company for the use of the siding they have constructed, and extending it to the Abattoirs.

Connected in this way with the railway lines, prompt and regular delivery of the meat could be carried out in refrigerating cars, and without the risk of taint. If the meat were intended for export it could be taken direct to the works which freeze and prepare it for shipment; and if for sale in Sydney it could be sent to the meat market, or as the case may be, to the depôts of the carcass butchers; and if for retail in the suburbs or country towns, it could be forwarded to the station at or nearest to these towns. A portion of the meat might also be distributed by the river, but the water carriage would be principally utilised for tallow, hides, manure, and other bi-products.

(5.) The distance from the saleyards to these works is under 2 miles, and the driving of the additional stock along the road from the yards to the works would add little or nothing to the inconvenience (with respect to which there are no complaints) now occasioned by the driving of the stock from the yards to the Company's works.

(6.) Through the proximity of the Sydney Meat Preserving Company's works to the Abattoirs the examination of the stock both before and after slaughter could be carried out at much less expense, and also, it is believed, more efficiently; while the nearness of the two places to each other would

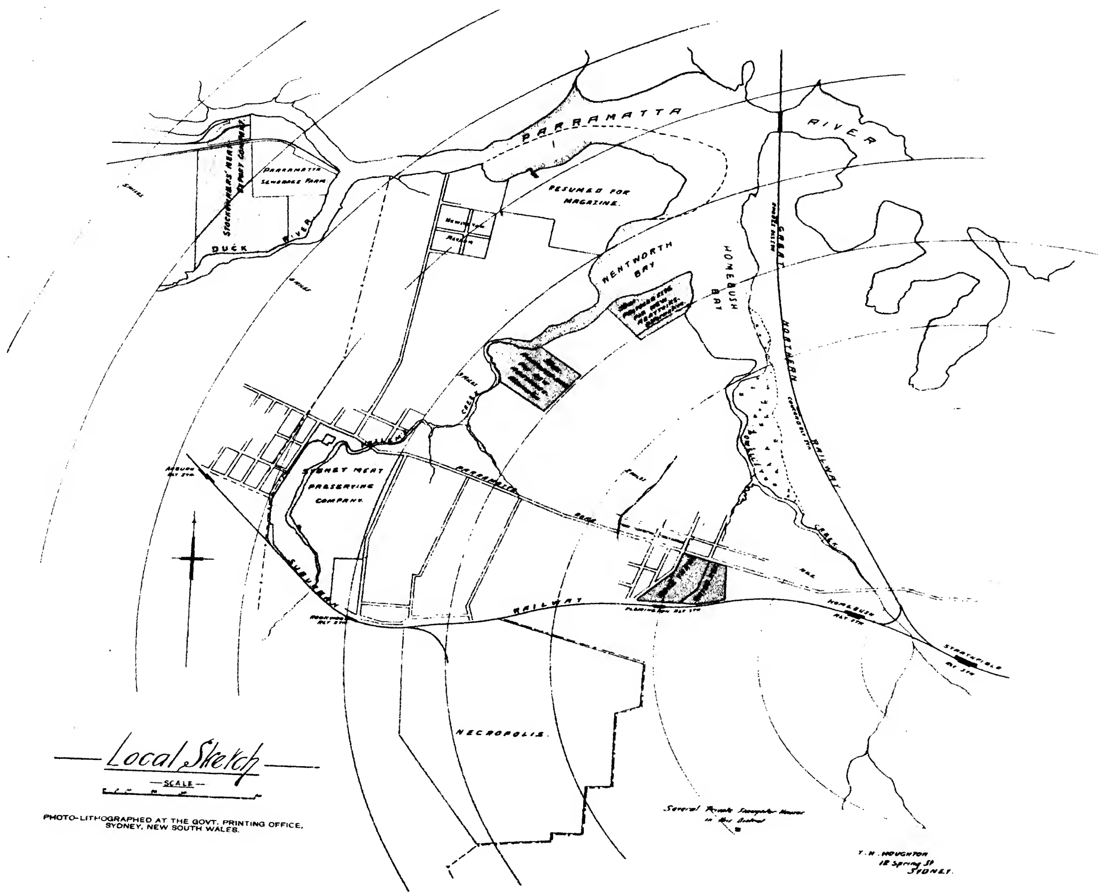


PHOTO-LITHOGRAPHED AT THE GOVT. PRINTING OFFICE, SYDNEY, NEW SOUTH WALES.

tend to the convenience of all those interested in the trade, and be advantageous in other respects.

(7.) If an arrangement could be made, as it is believed it can, with the Sydney Meat Preserving Company for the use of their siding, the expense of conveying the meat to Sydney and suburbs and to towns in the interior would be comparatively light.

(8.) By deepening Haslem's Creek at its mouth not only would the drainage from the meat-preserving works and the Abattoirs be promoted, but there would be sufficient depth of water at high tide to admit of lighters coming up to the works and the Abattoirs to discharge coals and other heavy loading, and to take away preserved and salted meat, bones, hides, manure, and other bi-products, and to some extent also for the transport of chilled meat at certain seasons of the year.

APPENDIX A.

Dear Sir, 12, Spring-street, Sydney, 21 April, 1897.

The cost of the buildings, machinery, plant, and appliances of a public abattoirs, suitable for the killing of 80,000 cattle, 1,000,000 sheep, 60,000 pigs, and 10,000 calves per annum, would depend very largely on the site upon which the buildings are to be erected, and also on the class of building adopted.

Assuming that the contour of the ground was suitable, and no great expense was required for foundations, I should estimate the cost of the necessary buildings, plant, &c., if wood and iron are used for the buildings, to be about as follows:—

	£
Slaughter houses, yards, drains and fences, offices and residences, roads and lanes, water supply inside the boundary ...	19,800
Railway and sidings, providing water supply ..	8,000
Electric light, desiccating machinery, digesters, tanks, &c.: engines, boilers, &c.; buildings for machinery ..	15,000
Chill-room and machinery, sorting-rooms, &c. ...	14,000
Land, say, 50 acres, at £100 per acre ...	5,000
	£61,800

The above is a very rough estimate as the conditions are so indefinite.

The revenue to be expected from the Abattoirs would be about as follows:—

	£
80,000 cattle, @ 1s. 3d. ..	5,000
1,000,000 sheep, @ 1½d. ...	6,250
60,000 pigs, @ 6d. ...	1,500
10,000 calves, @ 6d. ...	250
	13,000
Sale of manure ... Rent of chill-rooms and hanging-rooms ...	7,000
	£20,000

The probable yearly expenditure would be:—

Interest and sinking fund ...	2,500
Salaries and wages ...	9,000
Water and fuel ...	2,000
Repairs and renewals ...	2,000
Depreciation owing to temporary character of buildings ...	2,000
Management and contingencies ...	2,000
	£19,500

The above figures and any further information I can supply you with are at your service. I am adverse to the use of wood and iron for the construction of the buildings, but if it is a matter of cost it would be better to accept anything so as to get the Abattoirs removed from their present site, or, at any rate, to have them rebuilt.

Yours faithfully,

A. Bruce, Esq. T. H. HOUGHTON.

A Tobacco-growers' Association.

SAMUEL LAMB.

The Department of Agriculture has received a copy of the *Florida Agriculturist*, which contains, amongst other very interesting matter, a report of the meeting of a convention of the tobacco-growers of Florida, U.S.A., held at Quincy on 10th March last. From the President's opening address it appears that about nine years ago a few earnest men organised an association of tobacco-growers, under the name of "The Florida Tobacco-growers' Association," the objects of which were (first)—To collect and disseminate information on the subject of growing tobacco, and all details connected therewith; (second)—To encourage the cultivation of the finest types of cigar-leaf tobacco throughout the State of Florida, and thereby induce dealers and manufacturers to visit the State, establish packing-houses, &c.; (third)—To secure the enactment of all necessary legislation to foster and develop the industry.

This association, in conjunction with associations established in other States, did excellent service when Congress was at work; later, on the tobacco duties, in securing the passing of the present tariff under which imported wrapper-leaf pays \$1·50 (or 6s.) per pound, and imported filler-leaf, 35 cents (or 17d.) Customs duty on importation. The Committee of Ways and Means of the United States Congress has recommended that these duties shall be increased to \$2 per pound on wrapper, and 70 cents. per pound on filler. The cigar manufacturers and importers are strenuously opposing this proposal, and it was resolved that this Convention should pass a vote approving of the increase, and forward a copy of the same to Chairman Dingley, at Washington.

It was stated at the Convention that Florida tobacco has a character of its own, and so closely resembles the higher grades of Havana and Sumatra leaf that even experts are baffled to distinguish between them; and that the best grades of Florida tobacco have been extensively used in the manufacture of Havana cigars; so that instead of standing on its merits as an American product it has helped to build up the reputation and increase the sale of imported Havana tobacco.

The cultivation of this class of leaf was revived in Gadsden county only about ten years ago, and has met with such success that on a reasonable estimate fully 5,000 acres will be planted there this year.

A proposal was brought forward that it was desirable that the association should establish a central packing and curing house; but the opinion of the majority of the dealers and growers present was that the packing and curing business might well be left to take care of itself; for as soon as there was enough tobacco raised in any section, dealers would be sure to go there, purchase the crop, and handle it themselves. When the Florida tobacco became known on its merits, Florida would not be able to supply the demand which would arise for it.

This report is full of interest and suggestion to the tobacco-growers of New South Wales, for what is said of the Florida tobacco is true of some of the best of our tobaccos. The experiments at Moonbi have proved this.

The tobacco-growers of Florida appear to be a self-confident and self-helpful set of men. They are doing for themselves what the Department of Agriculture is trying to do for the tobacco-growers of this Colony; but the circumstances are very different in the two places. There they have a great market at their doors, which is heavily secured to them by high import duties on tobacco and cigars. They have to provide for the wants of about 60,000,000 of population, New South Wales only for 1,250,000. They have the great cigar factories of Key West to supply, and many others. Even the comparatively small city of Tampa pays wages to the amount of 50,000 dollars, or £10,000 per week, to the workers in the cigar factories. In this Colony we import nearly all the cigars and about half the tobacco we consume. In Florida capital is available and made use of. One cigar company had 900 acres planted last year, and will plant 1,000 acres this year. Its seed-plots alone cover 25 acres, and it has 2,200 bales of tobacco packed ready for home use or shipment.

If under such favourable circumstances the tobacco-growers of Florida find it desirable to have an association, how much more is there need of one in this Colony under our adverse conditions.

The total consumption of tobacco in New South Wales is not sufficient to absorb the production of any favourable season; and even if Federation should come, and come soon, this Colony could produce sufficient for the whole of Australasia with scarcely an effort. If, therefore, tobacco-growing is to be extended and developed, we shall have to look to outside markets in which to sell the leaf produced.

England, Holland, and Germany are large consumers, and their markets are open to us, and hungry for good tobacco; with medium and low-grade leaf they are already over-supplied, and if we are to establish our tobacco in those markets, it must be by means of high quality. We cannot compete, our labour is too costly to allow us to compete, with India, China, Japan, South America, or even the United States of America, in the production of cheap tobacco. We must send them better tobacco than they are now supplied with, and this is not difficult. My investigations and experiments have fully proved that really fine tobacco can be grown in many parts of the Colony. The Moonbi tobaccos are of very fine quality, and are admirably suited for cigarette making. Really good cigar-leaf has been and can be grown on the Hastings and Macleay Rivers, and there are many places, both in the northern and southern parts of the Colony which have produced pipe-smoking tobaccos of high grade. As in Florida, so here, all our tobaccos have a distinctive character and flavour, and will doubtless make a name and place for themselves in the open markets of the world when properly introduced, but there is much initial work to be done, which individual growers cannot do, but which a tobacco-growers' association could accomplish.

It must be remembered that small isolated lots of unknown tobacco-leaf have not the shadow of a show in a big market. England alone requires 100 tons of tobacco a day: Antwerp and Bremen, much more. Of what possible use would 20 or 30 bales of a new sort of tobacco be to any English manufacturers? They work on so large a scale that they have no leisure to even look at small shipments, such as individual growers could send, but a tobacco-growers' association could arrange that all the growers in one district should grow one sort of leaf, treat it in precisely in the same way in the seed-beds, the field, and the curing sheds; sort it by the same standards, pack

it in uniform packages, and ship it in one large shipment. That would challenge the attention of the whole trade, and very possibly take the market by storm, as the Borneo tobacco did about twelve years ago, topping the market at 3s. 3d. per lb. in Bremen. Such a shipment would show European buyers that New South Wales is not playing at tobacco-growing, but really meant business, and they would respect us accordingly.

There are many other ways in which a tobacco-growers' association could make itself felt; for instance, in legislation.

A tobacco-growers' association could also establish a central packing-house in each district. So far as I know, there is not one in Australia; there are hundreds in America. Tobacco-packing is a very good-paying business there. In the returns for income tax (I think for 1894 or 1895) there were fourteen tobacco-packing firms which returned their incomes at and over one million dollars each.

The tobacco-packer's business is to purchase tobacco-leaf from the grower, usually, as it hangs in the sheds, but sometimes green in the paddocks. He provides skilled labour to strip, sort, cure, and pack it, which is work that cannot be so well done by the ordinary farm labourer. A central packing-house would be a great boon in any tobacco-growing district.

There are many other ways in which a tobacco-growers' association could do useful service in developing the rich possibilities of the tobacco industry, and I most earnestly urge this matter on the attention of the tobacco-growers of New South Wales.

The Influence of Bees on Crops.

(Continued from page 339.)

ALBERT GALE.

The arrangement of the reproductive organs in blossoms vary very considerably in different classes of plant life, and the most casual observer mus- have noticed the many forms of insect life. Those insects that subsist on the honey they extract from flowers are, in many instances, so constructed as to appear to *fit* the flowers they visit. Again, the construction of certain flowers is only adaptable to the wants of certain insects. The nectary is so situated in different classes of flowers that the honey it contains can only be obtained by the insect *designed* to fertilise them. The length of tongue in moths, butterflies, and bees is well known, and its length plays no inconsiderable part in perpetuating varieties and species of the vegetable kingdom. In Darwin's work, "Fertilisation of Orchids"—a book everyone interested in the subject should read—he mentions one flower as having a spur-like form, from 10 to 11 inches long, with the nectary situated at its base, and for the purpose of obtaining the honey contained therein there must be an insect with a tongue of an equal length. It appears that this particular orchid is a native of Madagascar. Some orchid hunters, in searching that island for specimens, came across a moth with a tongue of corresponding length—evidently the agent employed by nature to fertilise this particular plant. Some plants are only met with in particular localities; in other localities, having the same conditions of soil, warmth, moisture, &c., they are entirely absent. Again, where some species of plants are found, certain insects are also to be met with, and *vice versa.* Thus, particular plants are dependant on certain insects, and particular insects on certain plants, for fertilisation.

In a previous article it was mentioned that the pollen-bearing organs were not always to be met with in the same flower. In the melon, cucumber, and other plants belonging to that tribe, some of the flowers are male—*i.e.*, possess stamens only, or have no pistil; while others are female—*i.e.*, possess a pistil but no stamens. The pollen of this tribe of plants is comparatively heavy and viscid. It is therefore obvious, as the two sexual flowers are situated at some distance the one from the other, a foreign agent must convey the pollen from the stamen to the stigma of the pistil of the female flower. In some of the Egyptian palm-trees there are what are termed male and female trees—*i.e.*, the sexual flowers are on separate and distinct plants. The trees are often at considerable distances the one from the other. The variegated laurel (*Aucuba japonica*) is another of these diœcious shrubs, and of course, like the palm-trees referred to, the male and female

flowers are on different trees. It was introduced into England many years ago by the Dutch from Japan. It so happened that the plants first introduced were female plants, or in other words bore female flowers only. There were no pollen-bearing flowers, consequently no seed could be produced, and propagation was carried on by cuttings only. Some years afterwards a Mr. Fortune introduced some male plants. These were planted in close proximity to some of the old Dutch ones that had been perpetuated by means of cuttings. The result was that an abundance of fertile seed was produced the following season.

The pollen of the variegated laurel is now an article of commerce in the London Covent Garden Market.

The length of time the pollen of some of the palms and laurels retain their vitality is remarkable. The pollen in others must be utilised soon after it is discharged from the anther or its procreative property is lost.

The quantity of pollen grains discharged from flowers is something enormous, especially in those plants where the sexual flowers are on different trees. The flowers on a Chinese laburnum (*Wisteria sinensis*) were calculated to contain no less than twenty-seven billions of pollen grains.

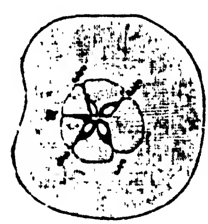
From these illustrations it will be noted the utter impossibility for certain plants to be perpetuated from seeds, or to produce fruit without aid from an agent outside themselves. Here the bee comes in to play its important part in our fruit-crops.

What I have said in relation to the distribution of the sexual flowers in the variegated laurel, palms, &c., is equally true and holds good in the blossoms of our orchard fruits, with this exception—that they have not separate sexual flowers, but the sexual organs are in one and the same flower. Notwithstanding this, the stamens mature, and the pollen is distributed some time (in some cases days) before the pistil, or rather the stigma, is sufficiently developed to receive it. Thus, while the male organs of some of the flowers have perfected, maturition in others is still progressing, and so with the pistil; so that the fertilisation of fruit blossom by its own pollen is as impossible as if the reproductive organs were on different plants, or at least on different flowers on the same tree; therefore a foreign agent is as essential to transport the pollen from hermaphrodite flowers as from that of diœcious. The oft quoted aphorism, "Nature abhors a vacuum," was reconstructed by Darwin into "Nature abhors perpetual self-fertilisation"; and the various ways Nature has arranged the pollen-bearing organs is Nature's safeguard against what is termed in-and-in reproduction, and cross-pollenation ensured. Cross-pollenation has long been recognised in the economy of the reproduction of members of the vegetable kingdom. It was known as far back as the time of Herodotus. He describes the process of the transference (caprification) of the pollen from the male tree to that of the female, by which means a crop of dates was ensured on the Egyptian palms.

Some early blossoming trees seem to burst forth suddenly, especially pears. In looking through a trus of pear blossoms that have just opened, it will be noted that the parts perfected are the calyx, the corolla, and the stamens. The pistils are still undeveloped. After the anthers have discharged their pollen, the ripening of the pistils commences; and by the time the stigma is receptive, there is no pollen from the first opening blooms where with these early-maturing blossoms can be fertilised. It is obvious that the all-important pollen must be obtained from some other flowers, or there will be a failure in the crop of the tree that has so blossomed. I shall point out further on that the pollen from any source, if the bees were to convey it, will be as great a failure as if the stigma were entirely deprived of that

fertilising influence. Seeds must be fertilised by pollen from their own species. A newspaper clipping—I think from a Brisbane paper that I have now in my possession—says: "If one were to plant 20 acres with stone pippin apples, or with Cleopatras, or with Duchess pears, and no other kind of apples or pears within a half-mile, it is not at all likely that there would be any fruit. *If there were not trees within the radius of half-a-mile, the experiment would be a failure; bees would carry pollen from other trees 2 or 3 miles away.* It is necessary to have a few of some other variety of apple or pear, which bears blossoms at the same, *or about the same, time*, and then they will pollenate each other, so that both varieties will bear fruit. Bartlett pears are fertilised by Duchess d'Augoulene, Easter Beurre, Anjou, and by others. The thing required is to have the flowers of each variety mature at *nearly* the same time. There is at least one instance in this Colony where a large block of apples of one kind has been planted for many years, and has never borne any fruit, although the trees are very strong and healthy, and bear perfect flowers every year. The pollen is ripe before the pistils are ready to receive it, and by the time the pistils are mature the pollen is all gone." The *italics* in this quotation are mine. I once read in an American paper a similar failure in connection with cherry orchards, where the bees had all been removed because they were accredited with eating holes in the ripe fruit, and thus reducing their market value. After the removal of the bees from the district the trees gave no, or at the most but a slight crop of fruit. After about three years, the bees were returned to that district, and the trees went on bearing as heretofore. With ignorant men, the poor little bees get the credit of a host of evil they never do. If all orchardists knew the value of bees, apart from that of honey producing, no orchard would be seen without them.

Every grain of seed requires a grain of pollen to fertilise it. By removing the husks from a corn-cob whilst in a green state a fine silken thread will be seen attached to each maturing grain. It is the organ of reception, and it is absolutely imperative for a grain of the dust from the anther (the flower on the top of the corn-cob) to fall or be conveyed to the point (stigma) of each silken thread. In a mature cob of corn, misses in the rows of grain are often observable. This is caused by the pistil not having received its necessary grain of pollen; and caused either by an injury to its stigma or an insufficiency of pollen. Deformed fruit are common occurrence, more especially with apples and pears. This is caused by imperfect fertilisation. It is clearly observable in the accompanying diagram. A section of an apple shows the five sections of the ovary, with four of the ovules of seeds, marked *f*, perfectly fertilised, and on the sides of the fruit, where the seeds are so fertilised, it is perfect in form. The unfertilised seed in the ovary, marked *u*, has caused the deformation in the fruit. If, in four out of the five sections seen in the ovary of apples and pears, the seeds therein are perfectly fertilised, the fruit is likely to develop, although it will be a deformity; but if only three be so fertilised the fruit seldom comes to perfection. The light seeds, those without kernels, that are frequently met with in pumpkins and other members of that family, are caused in a similar way—*i.e.*, by the bees being prevented by some cause from supplying a sufficiency of pollen to do the whole work necessary in reproduction.



(*To be continued.*)

The Treatment of Pelts.

The following leaflet was recently issued by the Department of Agriculture of New Zealand:—

Since the issue of Circular L.S. 62, dated the 1st September last, dealing with the flaying of hides and sheepskins, which is here reprinted, Mr. Rocke, of Messrs. Rocke and Sons, skin and leather merchants, London, who is on a visit to this Colony, and who prepared the circular for the London Chamber of Commerce, has kindly supplied the photographs from which the accompanying illustrations are taken.

An examination of these will show at a glance the effects of proper and careless flaying. The one properly done gives a workable surface of 8 ft., while the other gives only 3½ ft.

Mr. Rocke has clearly demonstrated the enormous loss to the colonies through the bad butchering of hides and sheepskins.

The careless flaying of hides and sheepskins, fire-branding of hides on the most valuable part, and the using of tar for sheep-brands, are matters which should engage the earnest attention of all interested.

John D. Ritchie, Secretary

Department of Agriculture (Live-stock Branch),

Circular L.S. 62. Wellington, 1st September, 1896.

The following communications have been received through the Agent-General from the secretary of the London Chamber of Commerce. The subjects referred to are of great importance to all interested in stock-raising, and should therefore receive early consideration.

John D. Ritchie, Secretary.

From the Agent-General to The Hon. the Premier.

Hides and Sheepskins.

10th July, 1896.

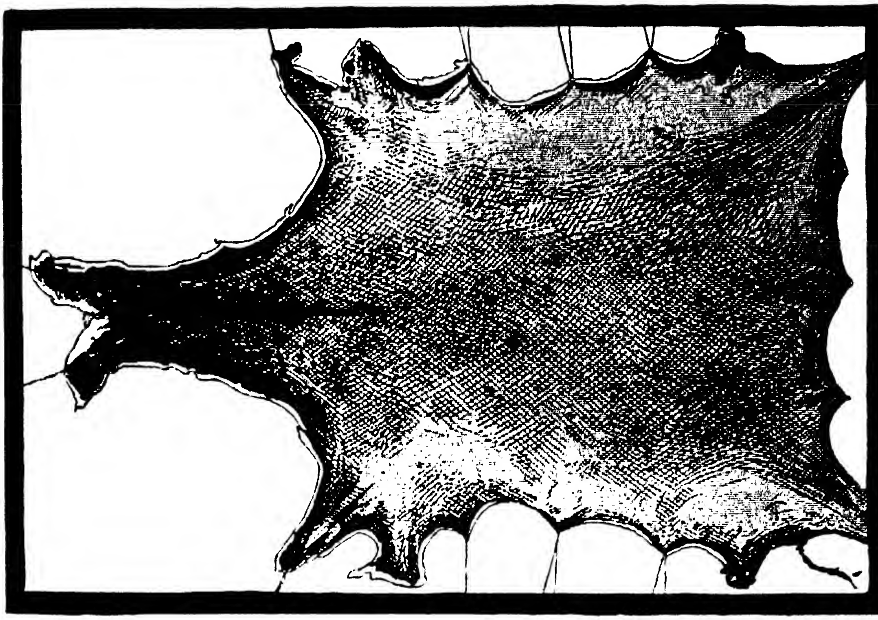
I beg to transmit herewith copy of letter from the London Chamber of Commerce, covering letter which has been addressed to the various Chambers of Commerce in Australasia, relative to the loss sustained by the improper flaying of hides and skins.

I venture to suggest that the matter might with advantage be brought also under the notice of the Agricultural and Pastoral Associations of New Zealand.

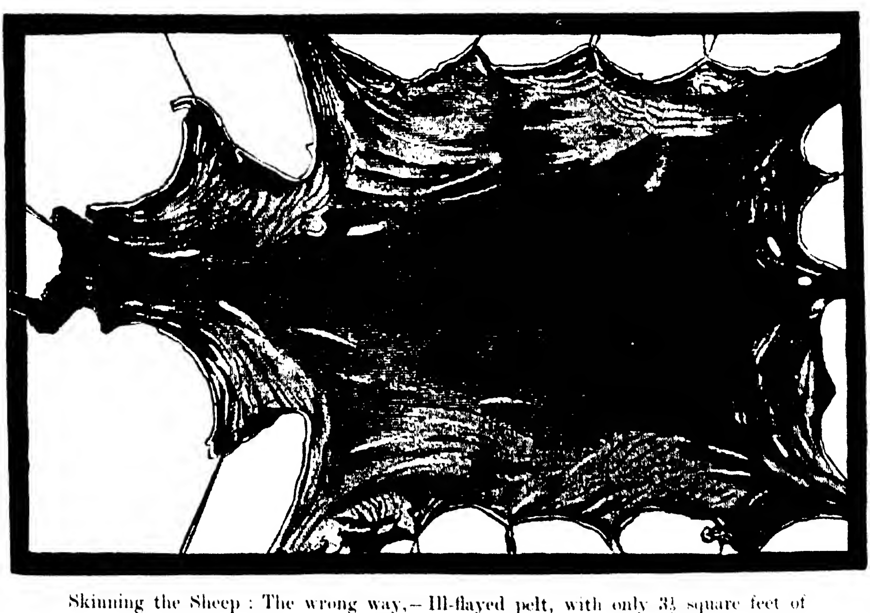
From the Secretary, London Chamber of Commerce, to the Agent-General, London.

7th July, 1896.

I am desired to forward for your information copy of a letter which has just been addressed, on behalf of the leather-trade section of the Chamber, to the various Chambers of Commerce in Australasia, relative to the great loss occasioned by the improper flaying of hides and skins.



Skinning the Sheep: The right way, Well-flayed pelt, showing 8 square feet of sound workable surface.



Skinning the Sheep: The wrong way,—Ill-flayed pelt, with only 3½ square feet of sound workable surface.

3rd July, 1896.

Damage to Australasian Hides and Sheepskins from ill flaying.

The leather-trades section of this Chamber has for a long time past had its attention drawn to the grievously unsatisfactory way in which a large portion of the hides and sheepskins imported from Australasia come to hand, due to recklessness and undue use of the knife of the butcher.

The result of this is a very serious loss, which, by the exercise of proper and constant vigilance, could in a very large measure be avoided, thereby rendering the goods more valuable and of readier sale.

The section fears that the serious character and extent of the damage is not adequately realised by those concerned; and the following facts are of interest in this connection:—

Hides.

1. The import of Australasian hides, including tanned sides, into the United Kingdom (based on the average of the four years ending the 31st December, 1895) is about 540,000.

The number of hides shipped to the Continent direct from Australasia is so small that, in view of the difficulties of getting reliable figures, they are not recognised.

It is estimated by the best authorities that the loss per hide on the whole number received cannot be less than 2s.

Sheepskins.

2. The import of Australasian sheepskins (skins in the wool, salted pelts and basils) into the United Kingdom is estimated at 10,820,000 per annum, these figures being based on the average of the past four years.

To this total must be added the woolskins shipped from Australasia direct to the Continent of Europe, the mean average number of which from New South Wales and Victoria for the four years ending the 31st December, 1894, is 1,474,453 per annum, exclusive of any which might be so shipped by the other colonies.

The gross quantity of sheepskins, consisting of woolskins, pelts, and basils, exported annually from all the Australasian Colonies, then, works out as follows, viz.:—

To the United Kingdom	10,820,210
To the Continent of Europe	1,474,453
	12,294,663

Upon sheepskins we estimate the loss at 2d. each skin over the whole number; and we may add that one of the largest dressers of sheepskins in the United Kingdom has just said, "If it were possible to get the skins from the sheeps' backs without a knife-mark on the flesh side, I am of opinion that it would add from 2s. to 6s. per dozen to the value of the pelts."

The figures given show an annual loss to Australasia due to bad butchering to be as follows, viz.:—

	£	s.	d.
Hides, 540,000, at 2s. each	54,000	0	0
Sheepskins, 12,294,663, at 2d. each	102,455	10	6
	£156,455	10	6

This annual loss would pay interest at 4 per cent. on a capital sum of no less than £3,911,388 2s. 6d.

As one of the leading objects of your Chamber is the fullest and most beneficial development of the resources of the colonies, the section feels sure of your hearty co-operation, and has the fullest confidence that you will take the needful steps to bring the subject of this circular before the notice of slaughterers and shippers with a view to remedy this preventible evil, to the benefit of all concerned. I would also venture to suggest that this letter might be communicated to the local Press.

28th May, 1896.

The attention of this Chamber, and of its Meat and Cattle, South African, and Australasian Trade Sections, has been drawn to the serious inconvenience and expense spinners and manufacturers are put to in consequence of the use of tar and other substances in the marking of sheep.

A large quantity of wool in its natural state is used in the manufacture of carpets and other goods, and, in consequence of the damage to the wool on account of the system of marking referred to, the wool requires to undergo a process of sorting in order to exclude the portion which would be injurious to the manufactured article.

This process of sorting entails expense as well as loss, the tar-marked wool being unsuitable for the manufacturer's purpose.

Notwithstanding this process of sorting, and the exercise of care and diligence, tar-stained wool in small quantities occasionally finds its way into the finished goods, and leads to serious complaints and formidable claims for compensation.

I am therefore desired to urge upon you the desirability of the adoption of a less injurious system of identification or marking which would not be subject to the same objections as the process now in use in many parts, and to express the hope that your Government will adopt the necessary means for bringing the grievance in question under the notice of those immediately concerned, with a view to their taking steps to remedy the evil complained of.

I would add that the carrying-out of this suggestion would be to the advantage of all concerned, as it would, no doubt, lead to the value of the wool being considerably enhanced.

From Mr. Henry Gray, Produce Commissioner, to the Agent-General.

25th June, 1896.

In accordance with your instructions, I have made inquiries upon the subject of tar-branded wool, about which a communication was received from the London Chamber of Commerce, dated 28th May last.

I have seen merchants and brokers in the trade, and find that the practice of branding with tar is still carried on in New Zealand, in spite of representations which have been made during many years past.

The subject has been revived by the Chamber in consequence of representations made by the Halifax Chamber. Complaints are constantly being received from manufacturers as to the loss which arises from finding what are technically known as "tar-tips."

It seems to be the impression of the trade here that the subject is too well understood by flockmasters to need reiteration. It is probable that the practice of branding with tar is carried on mostly by small and inexperienced growers. It should be forcibly brought to the notice of all who offend in this matter that they are incurring loss far outweighing any economy which may be gained in using tar in preference to other mixtures; these, although not of so lasting a character as the former, prevent the losses to which attention is now directed.

Spraying trees with Bordeaux mixture at Hawkesbury College. Pump used, No. 3 Climax, mounted on sledge; triple cyclone nozzles.

Swabbing vines at Hawkesbury College with sulphate of iron solution, after being opened round stock, and surface roots pruned.

Orchard Notes for July.

GEO. WATERS.
Orchard Manager, Hawkesbury College.

THE work for July is mainly a continuation of June work. The pruning of summer fruits should be pushed on where not already done. A few words on the method of fruit bearing on the different sorts of fruit trees will not be out of place. The whole secret of successful pruning is in the knowledge of how and on what wood the various fruits are borne. When this is acquired the art of pruning is greatly simplified and without it anyone is only working in the dark.

Where there are trees of different ages in an orchard, it is better to do the young ones before starting the fruiting ones, because the aim with them is to produce good vigorous wood and this is induced by early pruning. Do not be afraid to cut young trees hard back, remembering that the closer you prune the stronger will be the growth. I look upon the first few years of the life of a fruit tree to be all important, as no amount of work will bring an old tree back into shape if it is allowed to run rampant when young. No doubt it requires great determination to cut a beautiful looking lot of wood off, but bear in mind that off it must come if you want another beautiful lot the next and following years. This latter remark is specially adapted to peaches and nectarines.

In the case of the last-mentioned they bear their fruit on wood of the past year's growth, the blossoms rising immediately from the bud, the same shoot seldom bearing again except on casual spurs. In pruning these the aim should be to secure a succession of yearling wood. If these suggestions are carried out a great amount of thinning of fruit is avoided.

Apples and pears are entirely different to peaches, bearing their fruit upon small terminal and lateral spurs or short shoots which spring from branches of two or more years old. After the tree is once shaped, which is done very similarly to any other summer fruit, the annual pruning developes into merely cutting out cross branches or dead wood.

Cherries are produced upon small spurs on wood of two, three, or four years old, and the tree should be cut very sparingly during winter pruning. When limbs are to be removed it is better done in the summer after the fruit is picked. This is also just as advisable with young cherry trees.

Plums bear fruit somewhat similarly to cherries, viz., upon spurs on two-year old wood, and continue to bear upon them for many years, but unlike cherries should always be pruned in winter. The apricot, again, is much like the plum and should be very carefully pruned, especially until it is three or four years old. Endeavour to give every branch or limb a good hold on the main trunk and prevent the formation of forks, as the apricot is very liable to split.

Japan plums require a modification of peach pruning or rather a medium between the pruning of the peach and that of the plum, but unlike the latter they will stand a good amount of summer pruning in addition to the winter. They are rampant growers and most prolific croppers; in fact have a tendency to overbear to a fault.

The pruning of other fruit trees, such as almonds, figs, walnuts, chestnuts, loquats, and most all of the citrus trees, consists mainly in the removal of dead, broken, or unnecessary branches. This month is the best, generally speaking, for the pruning of grapes. Where grapes are grown for wine, instructions are seldom needed by the grower, so these remarks are intended for those who are growing a few table grapes. Generally speaking short pruning is the best, which consists of cutting back the young wood, leaving two eyes to each spur carried by the arms on the main stock. According to the age of the vine, two, three, or four arms should be left on the crown. Where the vines have been attacked by black spot, they should be opened up round the base of the vine and swabbed with the sulphate of iron solution, consisting of 5 lb. sulphate of iron, 4 oz. sulphuric acid, and 1 gallon water. All affected prunings should be burned. While pruning, all wood of vines for cuttings and trees for grafts should be carefully saved and laid in, almost entirely covered in some shady place until wanted. After pruning and several good cultivations with a large disc or Morgan spading harrow—if the soil is light this is necessary in order to break up the hard pan that forms at the depth that the land has been cultivated to during the year—summer fruit orchards should be sprayed as recommended in last month's notes, and this should be followed by a good ploughing. Where not already done, planting of young (deciduous) trees should be proceeded with as soon as possible. Do not plant too many varieties, a fault too frequently committed. Of course I do not mean not to plant a few good new varieties so as to test their value, if you can spare the money; but plant largely only of those varieties that you are sure will succeed best in your soil and climate.

Where slowly-acting manures have not been applied, no time should be lost in so doing, so that the necessary plant food may be available when the trees most require it.

Vegetable Notes, for the Month of July.

Now that we have had copious rains the spading over of all spare beds should be easy. The ground should be left as rough as possible, so as to well expose the surface to the beneficial effects of the weather. The best, as well as the cheapest, fertilizer for the vegetable garden is stable manure well rotted with straw, leaves, and all sorts of refuse. Care should be taken to collect the liquid from the stables and cowyard, as this is most valuable for mixing with the contents of the manure pit or heap.

In an article on "Forest Nursery Work," in the May *Gazette*, page 306, Mr. Jackson describes and figures three styles of seed-beds.

For seedlings of cucumbers, melons, tomatoes, &c., which need a lot of care at this time of the year, such beds, especially the one with the frame shelter would be invaluable.

Asparagus.—Ground should be prepared and everything in readiness for planting in August.

Jerusalem Artichoke—Require well manured, drained, and carefully worked soil. As a rule whole small tubers are planted, but large ones may be divided. Plant 4 or 5 inches deep, about 12 inches apart in rows of 3 or 4 feet.

Bean, French.—In places where frosts are likely to occur it is hardly worth while sowing this month.

Bean, Broad.—A few rows may be sown. It is well to remember that the roots of this plant extend to a considerable depth, and that it cannot stand excessive moisture. A well-drained spot where the soil is deep should therefore be chosen.

Broccoli.—A good quantity of seed may be sown well apart in rows in the seed-bed, which should be watered regularly. Transplant as soon as seedlings are a fair size.

Cabbage.—A little seed may be sown thinly in the seed-bed. It is a good plan to sow the seed in drills a couple of inches apart. Any seedlings from last sowing that are sufficiently advanced may be planted out in well-manured beds.

Carrot.—Put a small quantity of seed in drills, from 1 foot to 18 inches apart. When the plants are large enough thin out, and be careful to prevent the seedlings being choked by weeds.

Cauliflower.—Put in a little seed so as to have a succession, and plant out seedlings from previous sowings.

Cucumber.—Sow a little seed in a bed, similar to that referred to above, so as to have plants ready for putting out early in the season.

Capsicums or *Chillies* should also be sown in protected seed-beds.

Leek.—A little seed may be sown. Strong young leeks may be planted out in well-manured trenches. If the soil is dry they should be well watered.

Lettuce.—Sow a little seed and plant out seedlings on hand. Beds should be well manured.

Onion.—It is advisable to have onion beds long and narrow, so that all the weeding may be done from the paths. The ground should be very carefully worked, well manured, and drained. A good quantity of seed may be put in this month. Sow in drills and cover the seed very lightly with finely crumbled soil.

Parsnip.—A small quantity of seed may be sown.

Peas.—Sow largely. In preparing the rows for peas it must be remembered that the higher the growth of the variety the wider the rows should be. This will vary from 3 to 4 feet.

Spinach.—Should be sown in drills a couple of feet apart. When the seedlings show up thin out to about 12 inches from plant to plant.

Swede Turnip—Turnip.—Sow a little seed in drills.

Tomatoes.—The seed-bed, with arrangements for shelter, would be useful for sowing tomatoes, so as to ensure early crops.

General Notes.

Ramie Roots for Distribution.

Experiments conducted at the Wollongbar Farm on the Richmond River, with *Bœhmeria nivea* (Ramie or Rhea), have shown that this fibre plant will thrive to perfection in the loose, well drained sandy loams of our northern rivers district. The Minister for Mines and Agriculture is anxious to encourage the cultivation of this crop on a commercial scale, and contemplates offering at some future date a special prize for quantities of the product suitable for export. It is understood that a number of farmers at Maclean and elsewhere have already arranged to put in a small area this season. The manager of the Wollongbar Farm has a quantity of divided roots—from which the ramie is most readily propagated—and any one desirous of trying it this season may obtain roots on application to the Department. Applicants will, however, be expected to defray the cost of carriage.

Leguminous Crops for Pigs.

Considering the ease with which field peas and beans can be raised throughout pretty well the whole of the farming districts of the Colony, it might be worth the while of agriculturists who desire to add pig-raising to their operations to devote some attention to these crops. The method adopted by Mr. Wilson, whose ideas, as printed in the *American Agriculturist*, are given below, commends itself both as regards simplicity and economy. The chief expense of such a system would appear to be in the need for pig-proof fences; but with plenty of cheap timber, and the ingenious use of barbed wire, the outlay need not be heavy. Besides the addition of a lucrative branch to the farm, there is the direct advantage of land improved by the mere production of generous crops of legumes and the droppings of the animals that feed them off. It is far easier to manure land in this way than to buy expensive fertilisers and cart them on to the paddocks.

"*Corn versus Peas for Hogs.*—I have been raising hogs twenty years, feeding peas, peanuts, soja beans, &c., and find that corn makes the flesh much firmer and the lard whiter and firmer than when fed on any kind of peas. I am satisfied hogs will take on fat faster fed on peas than on corn. I think I have had hogs gain 2 lb. a day on peas and soja beans. My plan of feeding hogs is this: I sow the peas in one field and the soja beans in another; turn the hogs on the peas first and let them eat these, as they will rot sooner than the soja beans; then turn on the latter. When they get through the soja beans they are as fat as I want them, when I put them in a close pen and feed on corn two weeks to harden. I do not want anyone to think I am opposed to peas and soja beans. I plant more beans than corn, and think I get five times the profit from the first I do from corn.—W. H. Wilson, Norfolk Co., Va."

Mangolds at Minto.

Mr. E. Herborn, of Rosemount, East Minto, writes:—"I am forwarding you per to-day's passenger train a sample of mangolds (Yellow Globe) grown by me at East Minto. They are not of large size, and I do not send them merely as specimens of the root. My object is to show that a satisfactory crop can be grown in this district (where they would be invaluable for the dairy cattle) during the worst seasons. I am not aware that anyone else in this locality is at present growing them. When I point out that an acre of them, of the size I send you, if planted in rows 1 yard apart and 18 inches apart in the rows, would yield over 21 tons of fodder, it will be realised what a different position the dairymen would now be in if each had 2 or 3 acres to fall back upon for the winter. These have been grown, not as a garden crop but as a field crop, and in land typical of much more in the district. If desired, I can forward very full particulars and cultivation, rainfall, &c."

Pisé Buildings.

Some time ago there appeared in the *Gazette* an article by Mr. Lamb on suitability of pisé, adobe, or mud buildings for dairy and other purposes where uniformity of temperature is desired. Writing on this subject, Mr. Thomas Parkinson, of Sutton Farm, Arding, Uralla, says:—"The pisé or mud walls are coming into favour now for dairies. When I was building my house, twenty years ago, I was told that it would not stand, but it looks as good as ever. It is 56 feet long by 30 wide, with a kitchen 30 by 14 feet inside. I tempered my earth with a horse, and mixed straw with it; but nowadays they use boards, just damp the earth and ram it in, and there is, of course, not half the labour. However, people who have experience of the latter method think my plan better adapted to stand the weather. When the boards or boxes are used, plenty of mortar or cement is required to stucco the outside, because the moulded walls are not so hard as those built up with tempered earth. These buildings are warm in winter and cool in summer."

[Even to the man with the choice of half a dozen kinds of accessible materials, who can consult an architect, and whose participation in the operations need not extend beyond a stroll round the job on Sunday mornings, when he can sit on a mortar cask, dangle his legs, and wonder whether he will have a slate or a French tile roof, the erection of a house is no light affair. To the settler whose available material is confined to his standing timber and a mud pie the difficulties of the undertaking are apt to become overwhelming. The end of the matter is often a draughty, leaky hut, with all the discomforts of a makeshift dwelling. This is where the ingenious man gets a chance to spread himself, and that he does so to some effect is evident in the number of roomy, comfortable farmers' homes one may see in various parts of the Colony. Many of our readers, like Mr. Parkinson, have happily solved the house problem, and a few wrinkles from them might bridge over many a gaping difficulty in the way of the building operations of inexperienced and in some instances, unskilled settlers. If the owners and architects of some of the cozy farmhouses would care to send in their ideas we would be glad to publish the information, which would, without doubt, enable those of our readers less gifted in the practice of bush architecture to make the best of material at their command.]

Prickly-pear.

Mr. J. O'Shea, of Singleton, a few weeks ago, wrote:—"The experience in the troubles of drought that this district is undergoing at present tend to show that the Government committed an error in ordering destruction of the plant known as prickly-pear. We were compelled to destroy them some

years ago, and if we only had them back now, we would have no fear of losing our valuable dairy-herd, which will take almost a life time to put in profitable order again. Those who have pears in this district are feeding them to cows in a boiled state, either pure, or better (those who have the means) mixing a little bran with them ; and the cattle are not only living, but are giving a very fair share of milk. They also make an excellent mess for pigs, and they are keeping alive all the pigs that are in this district—in fact those who could find a little paddock of pears have shifted their cattle and pigs thereto, and erected boilers, from which a daily supply is served round to hungry and longing beasts. Those who cannot get pears, and they are the many, have their cattle dying already with only the approach of winter. Some have shifted them to the coastal districts, which is certain death to cattle reared in this district. By the above you may see the error of eradicating the prickly-pear."

There can be no doubt prickly-pear has come in very handy during the present trying season, but stacks of hay or ensilage put aside for times of scarcity would look more business-like than clumps of this horrible pest.

Replies to Correspondents.

Working Hill-side Orchards.

Mr. A. J. C. Vagele, of Mount Douglas, Paterson, writes:—"There seems to be a want of knowledge in properly treating hillsides on which orchards are planted. I find that it is almost impossible to cultivate them properly without losing the soil with heavy rains. Drains along the surface are not sufficient, as they soon fill up, and are in the way of working the ground in the summer. In winter a crop of prairie-grass, or stagger weed, is very good to hold the ground, but I would rather it could be done without. If the Department could give the readers of the *Agricultural Gazette* a hint on the above, it would be much appreciated by a large number of fruit growers about here, and I have no doubt elsewhere."

In reply, Mr. Allen, Fruit Expert, reports:—"As I have had some slight experience with raising fruit-trees on the side of a hill, I will endeavour to give our readers the benefit of same, which proved in every way satisfactory. It means additional labour, of course, but is only that entailed on every orchardist in an irrigation settlement when water for his trees is to be available, and the results more than compensate for any trouble. After each thorough cultivation (that is, after the orchard had been cultivated once each way, or more if necessary) I took a two-horse plough and ran a good furrow down between each row of trees—this, of course, only during the rainy season—and I found it always answered the purpose very well where the rain was not too heavy, each furrow having only a small quantity of surplus water to carry off. If, however, there is cause to expect very heavy rains, it would be advisable to go up and back in the same furrow, or even to make two furrows between each row of trees, so that there will be no danger of scouring, or of the furrows breaking away through having to carry too much water. On every hillside there are usually two angles at which the water will flow. For ordinary rains I would recommend running the furrow on the angle where it has not too great a fall; but where heavy downpours are of frequent occurrence, it will be necessary to run the furrows in the direction which gives them the greater fall, otherwise the water will break from one furrow into the other and destroy them. The furrows will have to be drawn out after each cultivation. This entails about half a day's work with a team, but the results prove that it is worth the trouble. It is advisable to have a ditch running along the top side of your orchard, so as to prevent any water from adjoining paddocks flowing over and washing the land away. On exposed hill-sides, where the sand is continually shifting with the winds, it is very often advisable to grow a crop between the rows of trees. A strip about 8 feet wide in the centre of the rows for the first year or two, while the trees are young, will be found a great help in protecting the latter; but where this is done it will be necessary

to give the soil a good manuring in order to avoid impoverishing it. When this course is adopted the grower will have to cultivate well and often around the trees, as the growing crop takes considerable moisture, and if the trees are not properly cultivated this would seriously retard their growth."

Wine turning Acid.

A CORRESPONDENT, writing recently about general viticultural affairs, mentions that some of his wine commenced to turn acid, and he was advised by a friend to use sulphate of magnesia and alcohol, as well as bicarbonate of potash. Before trying such specifics he thought it just as well to seek the advice of the Department.

The communication has been brought under the notice of Professor Blunno, Viticultural Expert, who says:—"In case of wine turning acid, sulphate of magnesia would not act or do any good, but would impart a bitter taste to the wine. Pure caustic potash is more preferable than bicarbonate of potash, and, applied in due proportion, would be effective. As the correspondent did not send a sample of the wine, no opinion can be offered as to the exact quantity of acetic acid already formed, so the best way to determine the exact amount of pure caustic potash to use is to take three bottles of the wine; put 15 grains in the first, 30 in the second, and 40 grains in the third bottle, to see the effect of each amount, and then apply the dose that is found suitable, remembering that six quart bottles are equal to a gallon, and calculating the amount of pure caustic potash accordingly. In taking the three bottles the wine should be drawn off, half from the top and half from the bottom of the cask. After having tried the effects of the different proportions on the samples, the whole quantity of potash that it is decided to use should be dissolved in two to four gallons of the wine according to the weight of the substance, and then poured into a clean cask, the bulk of the wine following afterwards.

"If the cask of this doubtful wine is rather big, and the *acetic taste* only *slight*, it means that the alteration has not reached the bottom as yet; so probably by separating the top with a syphon until the sound part is reached, a good portion of the cask could be saved. In such a case the wine in the top is kept separate and treated as indicated above with pure caustic potash, and the part still sound racked into another vessel that is clean, and has been previously smoked with fumes of sulphur. The cask into which the treated wine is put should be kept full, and should be watched. Keep the bung clean, and get rid of the wine as soon as possible. A blending of wine treated with caustic potash with a round full-bodied wine somewhat sweet, in the proportion that, judging by one's palate, seems best, would certainly make a wine more palatable for early consumption."

Seedlings from Grafted Trees.

MR. F. R. McDONALL, of Ulumbarella, Barraba, says:—"I have a peach-tree grown from a stone of a yellow Italian peach that was grafted to a late variety of cherrystone peach (ripening February and March). The fruit of this tree is a semi sort of slipstone; when very ripe resembling the Italian in size and colour of flesh, except being very dark red at the stone, which is very large, and it ripens fully three weeks after both parent varieties are done. To all appearances it is a different peach. Does growing seedlings from grafted trees always result in a cross-bred or different sort of peach?"

In reply, the Fruit Expert, Mr. Allen, states:—"In grafting or budding trees from one variety to another I have never found that the new variety followed in any way the tree grafted upon, or changed in any particular its habits or appearance, the object of grafting or budding being to propagate fruit similar to that produced by the trees from which the buds or scions for grafting were taken; for instance, if we had a Lady Palmerston peach-tree and wished to grow a different variety (say Comets) the latter, when budded on the L.P. tree, would not in any way resemble the Lady Palmerston, but would preserve in every way its own habits and peculiarities. A peach-tree raised from the stone of a grafted tree will sometimes closely resemble its parent tree; but this is a mere chance, as if all the pits were planted from any one tree there might be a dozen different kinds of fruit, and mostly of inferior quality—in fact, it is very rarely indeed that one gets a really good seedling peach. The peach described would not be a good one commercially, as the colour around the pit would condemn it for canning, and it would not be any good as a drying peach."

Setting Drain Pipes.

Mr. J. Kempy, East Hill, asks:—"In laying unglazed pipes for fruit-trees, would the drainage be better—(1) if the pipes had just enough clay to keep them firmly in their places, then about 6 inches of shale (such as taken from an underground tank and exposed to the air till it crumbles to pieces) placed on top, and then filled in (we intend draining to a depth of about 3 feet, and have a considerable amount of shale on hand); or (2), would a drain made only of said shale, put in about 1 foot thick, be likely to give satisfactory results?"

The Fruit Expert, Mr. Allen, reports:—"A little clay, placed around the tiles to keep them from shifting, and is quite sufficient without the addition of shale. If stones are available a good drain may be made as follows:—Dig a ditch, carefully grading it at the bottom; then place large flat stones at the bottom so as to form a clear passage of good size for the flow of water. The ditch is then half filled with rough field stone (with small sizes on top), and on these a layer of fine brush, hay, or straying. The rest of the ditch is filled with earth."

Woolly Aphis, or American Blight.

A number of correspondents have asked for advice concerning the treatment of this disease.

The Fruit Expert, Mr. Allen, has furnished the following particulars of remedies that, properly applied, have been found most effectual:—"If both branches and roots are badly affected, and the trees have started to die back, it is almost impossible to cure them; and I would strongly recommend rooting out the worst and burning them up, and replanting with blight-resisting stocks, such as Northern Spy and Majetin. Tree holes to be sprayed with tar water before new trees are planted. For trees affected in a less degree the following treatment, when the disease occurs on the roots, will be found most effectual:—4 lb. of sublimed sulphur, in an iron pot, with enough water to stir conveniently while boiling for twenty minutes; then add 1 lb. of caustic potash, previously dissolved, and, whilst still hot, add as much colza or other vegetable oil as will make it into a thick paint. Before it gets cold, with a large paint-brush, daub the mixture for the space of a foot round the butt of the stem of the tree. Rain will wash it into the roots, and the oil will tend to preserve its strength for years. For work above ground I

cannot recommend anything better than the resin compound; but it must be applied hot, in fact, for winter spraying it may be so that the hand cannot be borne in it; it will prove more effective if used this way. To mix the resin compound, take 3 lb. of caustic soda and 4 lb. of resin; dissolve in 3 pints of water over fire. When properly dissolved, add water slowly to make 36 pints, keeping the mixture boiling. Dilute this with 14 gallons of hot water; apply with a spray, very hot. This is for winter spraying only.

For Codling Moth,

Spray with a solution of Paris Green in the spring, just as the fruit is setting, on a cool, cloudy day, in the proportion of 1 lb. to 200 gallons of water, the mixture to be kept well stirred while using it. Spray again in about ten days after first spraying; also bandage the tree, and look at same at least once a week. Keep the orchard clean, destroying all rubbish which may be a breeding-place for insects of any kind.

Collar Rot.

MR. T. E. BROWN, of St. Ives, Gordon, asks: Can you advise me what to do with lemon trees from three to six years old, that gum from the ground to 2 feet or so up the tree?

The Fruit Expert, Mr. Allen, from the particulars given, is of opinion that these trees are suffering from collar rot, and he would strongly recommend that they be dug out and the land replanted with lemon trees on orange stocks. The trees should be planted shallow, and no water allowed to stand around them. If the soil is at all damp, good drainage is necessary. So far as Mr. Allen knows there is no certain cure for collar rot, and he has seen trees which have received the most careful attention and treatment for this disease eventually die. However, if the trees are not very badly affected it might be worth while to try scraping off all the rotten bark and wood clean, and then mixing equal parts of carbolic acid and pure tar, which must be applied to the affected parts only. It may have a good effect for a time.

Rearing Calves on Separated Milk.

MR. EDWARD GRINDLEY, of Mullumbimby, asks for information relating to the rearing of calves on separated milk: What is the best substance to add to take the place of the cream and the quantity; mode of mixing?

Mr. O'Callaghan says: "Separated milk should be fed warm and sweet to calves. For young calves that are not able to eat grass, &c., fat must be added to separated milk, and the best means of doing this is to get crushed linseed and dissolve or mix it in boiling water. Allow the mixture to stand till cool, and take about equal parts of the mucilage and separated milk, which when mixed will make an excellent calf food, as linseed, besides supplying the necessary fat, is very easily digested.

Wheat and Sugar-Beet for Nobiac District.

MR. JOHN M'KAY, of Nobiac, *via* Stroud, asks for information as to wheat suitable for his district; also, if sugar-beet would be likely to succeed.

Mr. Valder would advise trying a few rust-resistant varieties of wheat such as Australian Talavera, Marshall's No. 3 and No. 8, Venning's rust-resistant and Allora Spring for flour, and Algerian for poultry and pig feed. Sugar-beet should do fairly well if sown in well-prepared land in August.

Buckwheat.

THE value of buckwheat for poultry feed, and other purposes, is, judging by the number of inquiries received, becoming widely appreciated. Next month we hope to publish an article giving full directions for the extensive sowing of this crop in spring.

Restoring Worn-out Wheat Land.

MR. THOMAS CROSS, of Jindera, and numerous correspondents throughout the wheat-growing districts, have asked for advice as to the most economical and effective means of restoring the fertility of worn-out wheat land. Mr. Valder reports:—The best system that I know of for bringing what is known as "worn-out" wheat land into profitable cultivation is as follows: Plough the land in Autumn fairly deeply—say, at least 6 in.; then in the spring (September or October) harrow it well and sow cow-pea at the rate of 1 bushel per acre broadcast, or 1 peck per acre in drills. When the plants are commencing to form their pods roll them down and plough them in. Another plan, which is perhaps the easiest and best, is, instead of ploughing the plants in, to put sheep on the crop and feed it off, and then plough when the weather is favourable. If this treatment was repeated every fourth year, I consider that most wheat lands would bear good crops for an indefinite period."

Influence of the Moon on Vegetation.

MR. JOHN MORRISON, of Bolga Creek, Queanbeyan, writes: "I amd esirous of obtaining information on the influence of the moon on vegetation. I know a good many farmers in this district who sow their crops, kill for beef, castrate farm animals, &c., according to the moon. A few ridicule the moon theory, but I have never yet heard any one prove that the farmer is wrong who sows his crop according to the moon. Will the *Agricultural Gazette* give some information on the subject?"

This belief in lunar influences is common enough. Concerning it, the Government Astronomer, Mr. H. C. Russell, says:—"The belief in the influence of moonlight on animal and vegetable life comes down to us from the time when the moon was worshipped as a divinity, and control over animal and vegetable life was attributed to the orb of night. That faith, handed down from father to son, holds still in thraldom, in face of the infinitely higher conception of the Divine Being to-day, multitudes of the human race, educated and uneducated. It is so difficult to throw off myths that are handed down from father to son. Nevertheless science can find nothing to support them. The obvious way to decide the question for the individual is to try the two methods concurrently, for instance, plant or sow one half the field when the moon is favourable and the other half when it is unfavourable, and watch the result."

Sorghum Seed for Poultry.

IN answer to an inquiry by Mr. W. Nottley, of Belmore River (Macleay), as to the value of sorghum seed for laying hens, Mr. McCue, of the Hawkesbury Agricultural College, reports: "Sorghum seed (by itself) is not a good egg-producing food for hens. Wheat is the best grain food. Sorghum is useful only for young and growing fowls, and is not a first-class food."

About the most prolific seed-yielder of the numerous varieties of sorghum grown in New South Wales is "Kaffir Corn." This, mixed with other grains, is extensively used for poultry in the United States, and one of the most prominent poultrymen of Kansas, in a recent number of the *American Agriculturist*, says:—

Feeding for Eggs.—Overfeeding produces worse results than not feeding enough. If fowls do not eat rapidly, or scarcely eat any at all, it is an indication of overfeeding, and the remedy is to stop feeding until the hens get hungry. It is a mistake to feed hens three times a day—not only this, but it is a mistake to give them all the breakfast they will eat. From one-half to two-thirds of a meal in the morning, and a full meal at night, gives me the best results in eggs. This equally applies to fowls confined in breeding pens and fowls running at large. When fowls are confined, they must be furnished with grit, green food, lime, and a dust bath, and many things may be added. Old plaster, dry, is a good substitute for both grit and lime, as are crushed oyster shells. A good twice-a-week ration is meat scraps, and crushed bone meal or granulated bone. One of the most important things is a scratching shed, as the hens must be kept busy, and also happy, and if they are thus provided for and furnished with clean straw and chaff, they will be both busy and happy, if not o'verfed. Kaffir corn is one of the best egg-producing foods that I have used—equal parts of Kaffir corn and oats, and one-fourth of wheat and corn, all ground together for a hot mash in the morning, made by scalding with boiling water, using just enough water to leave it in a dry crumbling mass, and by no means sloppy. A little salt, and occasionally a little cayenne pepper, may be added. This should be fed in clean troughs, and never on the ground. The evening feed may be whole grain, but principally of any of the above mentioned grains except corn. This may be fed, but it must be used sparingly. It is a good plan to give them a good feed of any of the other grain first, and the last thing before going to roost give them their will of corn.—A. H. Duff, Kansas.

Young Bees thrown from the Hive.

Mr. Nottley, of Belmore River, asks: "Can you tell me why bees throw out their young just as the winter is starting? The bees about here seem to do it every year. The majority of bees thrown out seem to be almost full-grown."

Mr. McCue reports: "When there are not sufficient bees in the hive to cover all the brood and keep the heat up, the young bees that are left unattended perish of cold—chilled brood—and their dead bodies are thrown out."

Sore Eyes in Cattle.

Mr. Thomas Hampton, of Cecil Hills, says: "The cattle are suffering from very sore eyes, which comes on in the form of a light scum around the pupil of the eye, and continually grows until it covers the whole of the eye, making the animal quite blind. I have used burnt alum and several other remedies, but with poor results. The cattle remain blind for several weeks."

The disease indicated is probably epizootic ophthalmia, concerning which the Government Veterinarian, Mr. E. Stanley, says: "This affection is usually seen in several cattle or sheep about the same time in various paddocks in the same district. However, as the majority recover, little notice is taken of the disease in the early stages; but that is just the time

when proper treatment (if it were possible to apply it) would be of the greatest benefit. It is in the acute stage, when the inflammation is severe, the animal being almost blind, that treatment is attempted. Now, at this particular stage, much harm is done by injudicious treatment. Even yarding animals, unless done very carefully, will do more harm than good. The eye is a very delicate, sensitive organ to deal with; therefore, Nature is frequently the best restorer. She can be assisted by attending to the animal's comfort, having food and water accessible to the nearly blind animals, keeping them perfectly undisturbed and in shady places. It may happen that the animal becomes nearly blind in one eye, the other recovering. In such cases the disease becomes chronic, the cornea covering the eye remains a milky-white colour. Proper treatment in this form is sometimes beneficial in clearing the eye. For animals that can be handled, the following applications are recommended for the eyes:—For the first stage of the disease, 1 oz. of tincture of opium, 1 pint of water; or 1 oz. of liquor plumbi subacetate, 1 oz. tincture of opium, 2 pints of water. These may be applied two or three times daily. For the second stage, after the acute inflammation has subsided, 1 part of boracic acid, 60 parts of water; or 40 grains of nitrate of silver, 1 pint of water. These may be applied two or three times a week. In the chronic stages, finely powdered burnt alum may be blown on the eye once a week."

AGRICULTURAL SOCIETIES' SHOWS, 1897.

Society.	Secretary.	Date.
Dapto A. and H. Society ...	A. B. Chippendall	Jan. 6, 7
Albion Park A. and H. Association ...	H. Fryer ...	,, 13, 14
Gosford A. and H. Association ...	W. McIntyre ...	,, 29, 30
Wollongong A. and H. Society ...	J. A. Beatson ...	Feb. 3, 4
Cobargo A., P., and H. Society ...	T. Kennedy ...	,, 16, 17
Ulladulla P. and A. Society ...	C. A. Cork ...	,, 16, 17
Berrigan A. and H. Society ...	R. Drummond...	,, 17
Riverina P. and A. Society (Cereal) ...	W. Elliott ...	,, ——
Manning R. (Taree) A. and H. Association ...	H. Plummer ...	,, 18, 19
Lithgow A., H., and P. Society ...	J. Asher ...	,, 18, 19
Robertson Agricultural Society ...	R. J. Ferguson .	Mar. 2, 3
Bega A., P., and H. Society ...	J. Underhill ...	,, 3, 4
Southern New England (Uralla) P. and A. Association	Jas. Leece ...	,, 9, 10
Tumbarumba P. and A. Society ...	W. Willans ...	,, 9, 10
Tenterfield Intercolonial P., A., and M. Society ...	F. W. Hoskin...	,, 10, 11, 12
Coonabarabran P. and A. Association ...	E. May-Steers...	,, 11
Oberon A., H., and P. Association ...	A. Gale...	,, 11, 12
Berrima District (Moss Vale) A., H., and I. Society ...	J. Yeo	,, 11, 12, 13
Cobargo A., P., and H. Society ...	T. Kennedy ...	,, 16, 17
Crookwell P. and A. Association ...	W. P. Levey ...	,, 18, 19
Lismore A. and I. Society ...	T. M. Hewitt ...	,, 18, 19
Walcha P. and A. ...	F. Townsend ...	,, 23, 24
Cudal A. and P. Society ...	C. Schramme ...	,, 24, 25
Blayney A. and P. Association ...	J. Clements ...	April 1, 2
Mudgee A., P., H., and I. Association ...	J. Cox ...	,, 6, 7
Liverpool Plains (Tamworth) P., A., & H. Association	A. M'Leod ...	,, 6, 7, 8
Warialda P. and A. Association ...	W. B. Geddes...	,, 7, 8
Williams River A. and H. Association ...	W. Bennett ...	,, 7, 8
Cooma P. and A. Society ...	D. C. Pearson...	,, 7, 8
Orange A. and P. Association ...	W. Tanner ...	,, 7, 8, 9
Gulgong P. and A. Association ...	C. E. Hilton ...	,, 13, 14
Queanbeyan P. and A. Association ..	W. D. Wright...	,, 13, 14
Royal Agricultural Society ...	F. Webster ...	,, 14–20
Moree P. and A. Society ...	S. L. Cohen ...	,, 21, 22
Clarence P. and A. Society (Grafton) ...	J. Wilcox ...	,, 27, 28
Bathurst P. and A. Society ...	W. G. Thompson	,, 28, 29, 30
Hunter River (West Maitland) A. and H. Association...	W. C. Quinton	,, 28, 29, 30
Hay Hortic. Society... ...	J. Johnston ...	May 5
Namoi P. and A. Association (Narrabri)... ...	J. Riddle ..	,, 5, 6
Hawkesbury District Agricul. Association (Richmond)	C. S. Guest ...	,, 6, 7, 8
Upper Manning A. and H. Society ...	W. Dimond ...	,, 12, 13
Wellington P. and A. Society ...	R. Porter ...	,, 13, 14
Upper Hunter P. and A. (Muswellbrook) ...	J. C. Luscombe.	,, 19, 20, 21
Nyngan and District ...	E. H. Prince ..	June 1, 2
Brewarrina P. and A. Association ...	H. L. Cathie ...	,, 7, 8
Cobar P. and A. Association ...	W. Redford ...	,, 9, 10
Deniliquin P. and A. Society ...	H. J. Wooldridge..	July, 13, 14
Hay P. and A. Association... ...	Chas. Hidgcock.	,, 22, 23
Riverina P. and A. Society (Jerilderie) ...	W. Elliott ...	,, 27, 28
Condobolin P. and A. Association... ...	H. W. Grey Innes.	,, 28, 29
Lachlan P. and A. Association (Hillston) ...	Thos. Cadell ...	,, 30
Gunnedah P., A., and H. Association ...	J. H. King ...	Aug. 3, 4
Forbes P., A., and H. Association ...	F. Street ...	,, 5, 6
Corowa P., A., and H. Society ...	E. L. Archer ...	,, 19, 20
Cootamundra A., P., H., and I. Association ...	T. Williams ...	,, 25, 26
Grenfell P., A., H., and I. Association ...	G. Cousins ...	,, 25, 26
Grenfell P. and A. Association ...	Geo. Cousins ..	,, 25, 26
Northern Agricultural Association ...	C. Poppenhagen	Sept. 1, 2

Society.	Secretary.	Date.
Murrumbidgee P. and A. Association (Wagga)...	... P. W. Lorimer..	Sept. 1, 2
Burrawong P. and A. Association (Young) ...	... C. Wright ...	„ 1, 2
Albury and Border P., A., and H. Society ...	... Geo. E. Mackay	„ 8, 9
Murrumburrah P., A., and I. Association ...	... Miles Murphy...	„ 8, 9
Yass P. and A. Association	... Thos. Bernard...	„ 9, 10
Wallsend and Plattsburg A. H. P. P. and C. Society	... G. Gilmour ...	„ 9, 10, 11
Parkes P., A., and H. Association	... H. S. Harwood..	„ 15, 16
Junee P., A., and I. Association	... T. C. Humphrys	„ 15, 16
Burrowa P., A., and H. Association	... J. H. Clifton ...	„ 16, 17
Cowra P., A., and H. Association	... Fred. King ...	„ 22, 23
Temora P., A., H., and I. Association	.. W. H. Tubman.	„ 22, 23
Narrandera P. and A. Association	... J. F. Willans ...	Oct. 6, 7
Berry Agricultural Association	... A. J. Colley ...	Nov. 24, 25, 26

1898.

Dapto A. and H. Society	... A. B. Chippendall	Jan. 12, 13
Albion Park A. and H. Association	... H. Fryer ...	„ 19, 20
Kiama A. Association	... J. Somerville ...	„ 25, 26
Wollongong A., H., and I. Association	... J. A. Beatson ...	Feb. 2, 3
Robertson Agricultural Society	... R. G. Ferguson..	„ 8, 9
Shoalhaven A. and H. Association	... R. C. Leeming...	„ 10, 11
Ulladulla A. and H. Association (Milton) ...	... C. A. Cork ...	„ 16, 17
Tenterfield Intercolonial P., A., and M. Society	... F. W. Hoskin...	Mar. 9, 10, 11
Inverell P. and A. Association	... I. McGregor ...	„ 10, 11, 12
Berrima District (Moss Vale) A. H. and I. Society	... J. Yeo	„ 10, 11, 12
Cumnock P. and A. Association	... Thos. Howard...	„ 17
Camden A., H., and I. Society	... W. R. Cowper...	„ 23, 24, 25
Bathurst A., H., and P. Association	... W. G. Thompson	„ 23, 24, 25
Royal Agricultural Society of N.S.W.	... F. Webster ...	April 6–12
Richmond River A., H., and P. Society (Casino)	... Jas. T. Tandy...	„ 14, 15
Hawkesbury District Agricultural Association ...	... C. S. Guest ...	May ——

Secretaries of Societies are asked to forward dates of forthcoming Shows as soon as decided.

[4 plates.]

Eucalyptus Bosistoana, F. v. M.

"A Red Box."

Useful Australian Plants.

By J. H. MAIDEN,
Government Botanist and Director of the Botanic Gardens, Sydney.

No. 39.—A Red Box (*Eucalyptus Bosistoana*, F.v.M.)

A hitherto unrecognised timber-tree in New South Wales.

Introductory Remarks.—This is a box whose existence has been known, particularly on the South Coast, for a considerable time, but it was assumed to be the ordinary box, or grey box (*Eucalyptus hemiphloia*), or at least a form of it. Herbarium specimens were, however, procured both by Mr. J. V. de Coque, Timber Inspector, Public Works Department, and Mr. J. S. Allan, the Forester of the district, when it was observed that the tree could not be brought under *E. hemiphloia.* Shortly afterwards Baron von Mueller described the tree under the name of *E. Bosistoana*, as will be seen below. Some little confusion has arisen in connection with the Cabramatta specimens supplied to the Baron, those known as ironbark-box having been sent in error by his correspondents. The Baron informed me that it was his intention to amend his description of the species, but his failing health, which resulted in his death, precluded him from carrying out his intention. The characteristic by which the fruits of this tree may be recognised by the tyro consists in the unusually large number of valves of the fruit. I may mention that this tree in southern New South Wales and Victoria has sometimes gone under the name of *E. odorata*, a very reasonable mistake; but I do not think the true *odorata* is indigenous out of South Australia.

Vernacular Names.—" Called locally by the colonists of New South Wales 'Ironbark-Boxtree,' and in some places also 'Grey Boxtree.' "—(Mueller). I have already drawn attention to the mistake by which this tree was confounded with the so-called "Ironbark Box." Its most usual name in New South Wales is "Red Box," owing to the pale red colour of the timber.

It must not be confused with the well-known "Red Box" (*Eucalyptus polyanthema*) of the Mudgee district and southern mountainous districts. The colour of the latter timber is usually of a much deeper colour than that of *E. Bosistoana.*

Aboriginal Names.—" The 'Wul-Wul' of the aborigines of the county of Dampier; the 'Darjan' of the aborigines of Gippsland."—(Mueller).

Botanical Name.—" As richly oil-yielding and also as exuding much kino, this tree is especially appropriate to connect therewith the name of Joseph

Bosisto, Esq., C.M.G., who investigated many of the products of the Eucalyptus, and gave them industrial and commercial dimensions."—(Dedication of Baron von Mueller).

Botanical description.—This Eucalypt was described by the late Baron von Mueller in the *Australasian Journal of Pharmacy* for October 1895, and as it is not likely that many of my readers have access to the original description, I give it here:—

Finally tall.

Branchlets slender, at first angular.

Leaves on rather short petioles, almost chartaceous, mostly narrow or elongate-lanceolar, somewhat falcate, very copiously dotted with translucent oil glandules, generally dull-green on both sides, their lateral venules distant, much divergent, the peripheric venule (marginal vein) distinctly distant from the edge of the leaf, all faint.

Seedling-leaves roundish or ovate, scattered, stalked.

Umbels few-flowered, either axillar-solitary or racemosely arranged.

Peduncles nearly as long as the umbels or oftener variously shorter, slightly or sometimes broadly compressed.

Pedicels usually much shorter, rather thick and angular.

Tube calyx turbinate-semiovate, slightly angular.

Lid fully as long as the tube, semiovate-hemispheric, often distinctly pointed.

Stamens all fertile, the inner filaments abruptly inflected before expansion.

Anthers very small, cordate or ovate-roundish, opening by longitudinal slits.

Style short.

Stigma somewhat dilated.

Fruit comparatively small, nearly semiovate, its rim narrow, its valves 5-6 or rarely 4, deltoid, totally enclosed, but sometimes reaching to the rim.

Sterile seeds very numerous, narrow or short.

Fertile seeds few, ovate, compressed, slightly pointed.

This species in its systematic affinities is variously connected with *E. odorata*, *E. siderophloia*, *E. hemiphloia* and *E. drepanophylla*. A fuller account of this valuable tree will early be given.—(Mueller).

Leaves.—In his dedication, the Baron referred to the leaves as "richly oil yielding," but I am not aware that we have as yet any specific data to go upon, either as to yield or composition.

Exudation.—Baron von Mueller states that this exudes much kino, but I have not yet received samples of it.

Bark.—The bark on the lower part of the trunk is persistent, the upper part has a smooth gum bark; it is, in fact, an ordinary box-bark.

Timber.—This timber resembles that of the ordinary box (*E. hemiphloia*) a good deal, its chief superficial difference being that, particularly when fresh, it has a pinkish or pale reddish colour. Now that attention has been prominently directed to this timber, it would appear desirable to discuss its merits (or demerits), taking the true box or grey-box for comparison.

It has been, and is now used by the Department of Public Works for the construction of bridges in the Bega, Eden, Bombala, and Cooma districts. It is also a favourite timber for fencing purposes. In response to an inquiry, Mr. Forester Allan states that the box in the vicinity of Wyndham is the same species, and of good quality, and has been used in the construction of bridges in the Bombala district.

Following is an extract from an official report furnished by request to the Forest Department by the Engineer for Bridges, Public Works Department:—"The chief objection to the timber is its free grain, which renders it liable to split and open with exposure. This characteristic prevents the use of it by the Department in truss work, where the timber used is cut into sizes in which splitting would be a serious weakness. It has, however, been used, and it is at present used, by the Department for piles and girders in the districts in which it grows. I am not aware of any such plentiful supply of the timber being available as to make its use, outside the districts in which it grows, probable."

I have made personal inquiry into the merits of this timber in the districts in which it grows, both in southern New South Wales and Victoria, and I believe it to be a really valuable timber. At the same time, it has been for a long period of years confused with other timbers, and it is not likely that we are yet in a position to assess it at its real value. Correspondence on the subject is invited.

Following is a copy of the official report on engineering tests applied to this timber, furnished by Professor W. H. Warren, of the University of Sydney, to the Under Secretary for Mines and Agriculture, in January, 1895. The timber was supplied to Professor Warren under the name of "Red Box":—"The results of the transverse tests are very important, as they show the relative strengths of the timbers in small and large beams. From an inspection of the enclosed table it will be seen that the large beams are 25 per cent. weaker than the small beams, as the mean modulus of rupture is 4·9 tons per square inch in the former and 6·55 tons per 89th inch in the latter. The smaller sections are about the same as those used for my experiments on Australian timbers recorded in the book published by the Government Printer, whereas the larger sections are similar to those used for bridge construction. From the results of experiments on similar small and large sections of ironbark timber I obtained the same percentage of reduction of the modulus of rupture in the larger section as that now recorded for red box. I have included in the enclosed table the results of testing two large beams of ironbark timbers, which are about as strong as the red box beams of similar scantling. The ironbark beams were not good specimens, and contained several large cracks, whereas the red box beams were perfect specimens.

"The results of the compressive and shearing tests of red box timber are about 25 per cent. lower than those obtained by testing similar sizes of ironbark timber, as will be seen by comparing them with those given in my book on Australian Timbers."

"NOTE.—The modulus of rupture is found from the formula—

$$f = \frac{3\,wl}{2\,bd^2}$$

"The modulus of elasticity from the formula—

$$E = \frac{wl^3}{4\,vbd^3}$$

(See page 19, "Australian Timbers.")

TRANSVERSE Shearing and Compressive Strength of New South Wales Timbers.

Local Name.	Number & Letter.	Size of Specimen in inches. Length.	Breadth.	Thickness.	Weight per cubic foot.	Total breaking load in pounds.	Modulus of rupture pounds per sq. in.	Modulus of elasticity.	Remarks.
		ft.	in.	in.		span 48 in.			
Transverse— Red box....	A	4·5	6·01	3·82	76·7	17,070	14,014 6·25 tons.	2,636,600	Clean fracture.
	B	4·5	5·5	4·3	75·4	21,700	15,364 6·86 tons.	2,234,100	,, ,,
	C	4·5	5·2	3·7	74·8	14,500	14,665 6·55 tons.	2,691,500	,, ,,
						tons span 15 feet.			
Ironbark ..		16·56	11·50	11·50	73·8	25·83	10,362 4·63 tons.	1,489,900	Broke by shearing longitudinally along fibres at end.
		16·56	11·875	11·875	70·0	32·02	11,650 5·20 tons.	2,236,300	
		17·00	12·75	12·75	..	36·472	107,273 4·79 tons.	2,094,600	
		17·10	12·25	12·25	77·0	36·165	11,934 5·35 tons.	2,291,200	Broke by shearing longitudinally along fibres at end owing to a crack near neutral axis.
		in.			area.		Breaking load in pounds per sq. in.		
Compression— Red box....	A	12·25	2·875	2·875	8·266	72,600	8,782·9	1,796,400	Sound fracture.
	B	12·0	3·25	2·89	9·392	71,900	7,655·4	2,221,900	,, ,,
	C	12·25	2·875	2·5	7·187	59,400	8,264·9	2,272,400	,, ,,
Shearing— Red box..	A	6	4·12	1·875	11·25	18,000	1,600	......	Sound timber.
	B	6	3·875	2·25	13·50	19,825	1,468·5	......	,, ,,
	C	6	3·875	2·25	13·50	17,777	1,316·8	......	,, ,,

Size.—A beautiful tree; grows to a large size—from 70 feet to 150 feet in height, and from 6 feet to 20 feet in circumference.

Distribution.—Following are the localities given in Baron von Mueller's original description:—"In swampy localities at Cabramatta, and in some other places of the county of Cumberland, and also in the county of Camden (Rev. Dr. Woolls); near Mount Dromedary (Miss Bate); near Twofold Bay (L. Morton); near the Genoa (Barnard); on the summit of the Tantowango (? Tantawanglo) Mountains, and also near the Mitchell River (Howitt); between the Tambo and Nicholson Rivers (Schlipalius); near the Strezlecki Ranges (Olsen)."

Following is an ampler description of the New South Wales localities in which the tree is most commonly found:—From Moruya to the Victorian border, between the coast range and the sea, in the counties of Dampier and Auckland, and on the south-east of the county St. Vincent. Its presence indicates good land. It was very plentiful in the Moruya, Bega, and Eden districts before settlement, but at present is only to be found in small patches, scattered more or less between Moruya and Eden.

Reference to Plate.—A. Fruit. B. Leaf, showing venation.

Perotis rara, R. Br.

"Comet Grass"

No. 40.—Comet Grass (*Perotis rara*, R. Br.)

Botanical Name.—*Perotis*, from the Greek word *peros*, wanting or deficient, though the author of the genus gives no indication of what part he desired to indicate as deficient (supposing such to have been his idea); or, perhaps, from the Greek *otites*, eared, with long ears, and *peri*, around, referring to the long awns; *rara*, Latin, signifying seldom seen, or unusual. It is not a very common grass.

Many botanical authors do not indicate the meaning of the generic or specific names they found, and it is not always obvious what an author's meaning is. It is very desirable, I think, that authors should always explain their own botanical names, except, of course, in cases where they are self-evident.

Vernacular Names.—"Comet Grass" of Queensland. This is Mr. Bailey's designation, and in his absence in Northern Queensland, I am unable to enquire whether he gave the name because of the grass being found near the Comet River, Queensland, or because the graceful spike was thought to resemble the tail of a comet.

Botanical Description (B. Fl. vii, 509).

Stems from a decumbent or branching base, slender, ascending to 1 foot or rather more.

Leaves linear, with subulate points, glabrous except a few marginal cilia especially at the orifice of the sheaths; *ligula* ciliate.

Spike or raceme in some specimens 3 to 4 in., in others at least twice as long.

Spikelets always numerous, at first erect at length reflexed, in some specimens almost sessile, in others on pedicels of ¼ to above ½ line long, often ciliate with a few hairs; the spikelets very narrow, 2 to 3 lines long without the fine awns, which are ½ in. to 1 in. long.

Outer glume with a prominent keel, sometimes glabrous, in a few specimens ciliate with rather long hairs.

Second glume similar, but rather shorter and narrower.

Value as a fodder.—This is a quick grower. Some observers say it is succulent, and stock are stated to be fond of it; but Mr. P. A. O'Shanesy, speaking of the dry summer of 1881, stated that he has observed that goats will not eat it, even in places where there are no other grasses.

Bailey alludes to it as "a small decumbent grass, affording excellent sheep-pasture in open country; growing quickly after showers; the seeds though sharp are not very troublesome."

Some of our stock-inspectors do not appear to be able to appraise the value of this grass, and their attention might be drawn to it.

We know so little about the fodder value of *Perotis* that it may be interesting to note that, speaking of the closely allied Indian *P. latifolia*, "Roxburgh says that cattle are not fond of this grass; Mr. Lowrie, however, states that at Ajmere it is considered to be a good fodder grass" (Duthie).

Other uses.—Its inflorescence is ornamental, and may be used for decorative purposes.

Habitat and Range.—Found in South Australia, also in New South Wales, through Queensland, to Northern Australia. It is always an interior species in this Colony. The Stock Inspector of the Bourke district says that it grows prolifically on sandy and red ground, and is not to be found on black soil anywhere.

Reference to Plate.—A. Part of the spike, enlarged, to show the attachment of the spikelets. B. A spikelet showing the two very long awns at the extremity of the glumes. C. Unripe grain, very much enlarged.

Botanical Notes.

A Fodder Plant for the Arid Interior (*Portulacaria Afra*, Jacq.)

It is self-evident that it is desirable to grow any good fodder plant that will flourish in the arid interior. Our choice of plants for such situations is not great. Let me draw attention to what Don calls the African purslane tree. The Boers of South Africa name it spekboom (fat-tree). It is a tall shrub or small tree, growing up to 10 or 12 feet in height. It has small round fleshy leaves, which is not surprising, since it belongs to the *Portulaca* family, of which we have one specially-useful member in this country, the common purslane (*Portulaca oleracea*), which has enabled many a mob of cattle to traverse a waterless stage.

Following is what Baron von Mueller says of the purslane tree in his *Select Plants*:—"Affords locally the principal food for elephants; excellent also for sheep pasture, according to Professor McOwan; hence this succulent shrub may deserve naturalisation on stony ridges, and in sandy desert-land not readily otherwise utilised. Would likely prove acceptable to camels also. Mr. T. R. Sim states that all kinds of pasture-animals eat it readily, and when grass is scarce nearly live on it. Grows on hot rocky slopes. Likes particularly doleritic soil. Displays an extraordinary recuperative power, when broken by browsing animals, or when injured from other causes. The trunk will attain 1 foot in diameter (McOwan). Cultivated by the author already in Victoria forty years ago."

Its native home is the Karoo, the arid country in South Africa which appears to present so strong a resemblance to much of our far interior. I cannot find any record of it having been tried in the far west, and I recommend it for careful trial for the following reasons:—

1. It may be readily propagated, rooting readily from cuttings and even solitary leaves during the greater part of the year.
2. It has no thorns or prickles, nor any objectionable characteristics that I know of.
3. Like many succulents, it attains its greatest luxuriance in hot dry localities.
4. Stock are fond of it, its succulent leaves providing both food and water for them; it is reputed to be moderately nutritious.

I am not inclined to go into ecstasies over any plant, but I see no reason why this one should not usefully supplement the scanty vegetation of our desert country. South Africa has put some of our salt-bushes to good use; let us make use of her purslane-tree by way of reciprocity.

It is a very brittle plant; hence stock easily break the plants up in their eagerness to eat them. The same thing applies to the Old Man Salt-bush, which will assuredly become extinct unless it is protected. This salt-bush and the purslane-tree should be fenced in and cultivated, until a considerable number of plants have been raised. A reserve stock should always be kept in what may be called the "nursery." By the way, there should be a nursery on every selection and station for the propagation and acclimatisation of desirable plants.

There are a number of these purslane-trees (or rather purslane shrubs) in the Botanic gardens, and the Department of Agriculture will propagate some in the vicinity of the artesian bores and tanks where public officers will be able to give them the little attention they require until established. A few cuttings are still available at the Botanic Gardens, and will be issued to applicants who reside in the arid western country, and who will undertake to test the plant and report.

The Alleged Poisonous Nature of Sorghum.

To the genus Sorghum belongs Planter's Friend or Imphee, Amber Cane, and other fodder plants. They have from time to time been reputed to have caused the death of stock, and the deaths have been attributed either to hoven, or to the presence of a specific poison (not hitherto isolated) in the plant. A note on the subject will be found at page 251 of the *Agricultural Gazette* of New South Wales for April, 1896. Attention has again been drawn to the subject by the publication of a paper by Veterinary-Captain H.T. Pease, in the *Agricultural Ledger* (1896, No. 24), Veterinary Series, No. 23, published by the Indian Government, entitled "Poisoning of Cattle by the Juar Plant (*Andropogon Sorghum*)." This is a synonym of *Sorghum vulgare*, and the poisoning is attributed to the large deposits of nitrate of potash that under certain conditions are thrown down in the stems. The death of stock by eating a sorghum has not been attributed to this cause before, I believe, and the matter is worthy of careful consideration. At the same time, in my opinion, the matter has not reached finality, and we require absolute confirmation of Mr. Pease's results.

Pepper-tree Oil.

The pepper-tree (*Schinus molle*, Linn.) is very largely cultivated for ornamental purposes in this Colony, and its bright-coloured aromatic fruits are well known. Messrs. Schimmel & Co. of Leipzig, Germany, have recently prepared an oil from these fruits, and their account of it will be read with interest:—

"This tree, indigenous to South America, is commonly cultivated in southern Europe on account of its graceful pinnate leaves and sweet-scented yellow racemes. A beverage, somewhat resembling wine, is prepared from its aromatic berries. In taste, they are first sweet, then spicy, and finally sharp and peppery, wherefore they are much used in Greece in place of pepper. In odour, they resemble elemi, but at the same time recall the odours of pepper and juniper.

"We distilled a lot of the berries received from Mexico, and obtained 5·2 per cent. of a thin oil having the odour of phellandrene, the sp. gr. of 0·850, and an angle of rotation of $+ 46° 4'$; it furnishes a clear solution with 3·3 and more parts of alcohol.

"When treated with sodium nitrate and glacial acetic acid in its solution in petroleum ether, the characteristic phellandrene nitrite is formed. When shaking the oil with sodium hydrate solution, a small quantity of a substance which consists mainly of a fatty acid is obtained; only traces of phenols could be found.

"Pepper-tree oil was examined in 1884 by Spica (*Gazetta chimica*, 14,204). He found pinene and a phenol which the author believed to be thymol on account of its nitrite melting at 156°, but he failed to obtain this phenol in crystals, although thymol readily crystallises.

"According to the '*Jahresbericht über die Fortschritte der Pharmacie, &c.*' 1887, page 25, pepper-tree oil was obtained by Helbing by distillation of the berries with steam. He obtained 3·357 per cent. of oil." (*Semi-Annual Report of Schimmel & Co.*, Leipzig and New York, April, 1897, page 44).

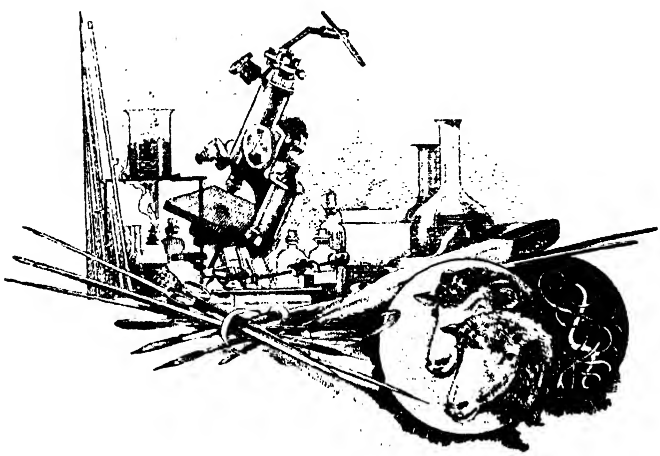
The Sheep-Fluke.

By N. A. COBB.

Introduction.

Bathurst Experiment Farm, 5 *April*, 1897.

These opening paragraphs are to explain how this article came to appear in its present form.

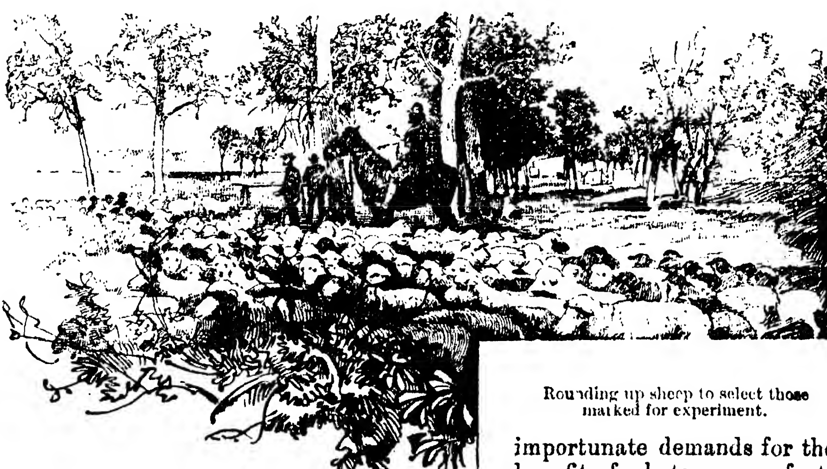


For many years the author has given considerable attention to the parasitic diseases of man and animal. A few years ago he was directed, in his capacity of Pathologist to the Department of Agriculture of the Colony of New South Wales, to make inquiry into the nature and history of the various parasites of stock. Accordingly, under the auspices of the Stock Branch of the Department of Mines and Agriculture, he undertook at Moss Vale, and later on at the Bathurst Experiment Farm, to give as much time as his numerous other official duties would allow to unravelling some of these complicated matters. In doing so he has always, and as he believes justly, held up the difficulty of such investigations as a warning against the expectation of early and important results. In regions of research where the greatest naturalists of the past have made but tardy progress, where great and industrious minds applied through long and laborious lives have succeeded in adding to our store of knowledge only here and there an important fact, it behoves the investigator of the present to be very cautious about promising anything greater as the result of his own

prospective researches. Though, therefore, the researches at present to be described are not barren of results, some of which have led to recommendations of great practical value, the reader is asked not to expect what is impossible.

Experiment sheep, grazing, Moss Vale.

Even now these pages would not have been laid before the public if the author's wish alone were consulted. For his own part, he would fain have waited until many investigations he has now in hand had yielded their results, so that he might lay before his readers a more complete picture of the life of the scourge he is describing, and so that his recommendations of a practical nature might be even more complete and useful. But a public officer engaged upon scientific investigations is often placed in this curious, and to himself sometimes uncomfortable, position: his clients, the public, whose funds he is using, make such



Rounding up sheep to select those marked for experiment.

importunate demands for the benefit of whatever new facts he may have discovered, and give such forcible reasons for their demands, that he feels bound to comply at the earliest possible moment. Now there is always a time in every investigation during which the result is comparatively certain, though it may require a long time yet to make a complete demonstration. Observe now the rack upon which the scientific public servant is stretched. Suppose he has made an important discovery: his reputation depends upon the freedom of his researches from mistake—and

The next victim!

I suppose there is no class of men more apprehensive of mistake, or

more fully informed of how easy it is to make mistakes, and of how common mistakes are. He must resist the public demand for the results of his work, and he must resist the pressure of his own feelings, until he is perfectly certain he is right. He must, it may be, repeat months or even years of work to corroborate his first result, and eliminate all chance of error. He must, in fairness to his scientific confrères, ascertain whether any one of them may not have reached the same conclusion. When torn by these various feelings, and while yet in a state of uncertainty, mayhap he is prematurely ordered by his department to make his results known, and then, as we know from some few conspicuous cases, disastrous results may follow.

Again, the results of an investigation allowed to go forth in driblets, are much less

Collecting and removing sheep-parasites for examination.

impressive than if reserved and presented in proper connection, and as a whole. This, however, is a matter that concerns the investigator more than it does the public whose servant he is, and any public scientific officer who reserved his results for this reason alone would be justly criticised.

In deference to this latter fact, and the wishes of his confrères, the author submits the following fragmentary observations, with the hope that they may yet appear in a more connected and extended form in a general work on Australian parasites.

Brief Resumé of our knowledge of the Sheep-fluke.

Our knowledge of the sheep-fluke extends back into remote antiquity, and though the older observers knew the disease caused by the fluke rather by its effects than through its cause, it is beyond dispute that at a very early date the disease was assigned to its true cause—a flat, worm-like parasite found in the liver. No doubt other diseases, such as anthrax, were confounded by the ancients with the true liver-rot, as it was often called; but this fact does not obscure the other fact that the parasite was known as the cause of a fatal disease contracted on wet and swampy ground.

As it is the object here to be as brief as convenient, no mention will be made of the numerous and vast epidemics of the past that have swept off sheep by thousands,—it is said even by millions. These details and many others will be left to be dealt with on later pages. Let our first object be to get an accurate general view of the subject, regardless of the less important details. Suffice it to say, then, that whenever these epidemics prevailed, they were accompanied by unusual circumstances of weather or pasturage, and the livers of the dead sheep were invariably found crammed with fluke. (*See* Fig. 6).

These flukes were flat worms, of a flesh or darker colour, capable of varying their shape, but for the most part having a somewhat spade-shaped contour. Some hundreds of these were often found in the gall bladder and ducts of a single liver.

The observation of practical men soon taught them to associate the unusual prevalence of fluke with damp seasons and swampy pasturage, and it was observed that even cattle and other stock grazing on such land became more or less infected with the fluke (always in the liver), though these other animals did not suffer so severely as sheep. The list of animals subject to fluke grew until a dozen or more widely different vertebrates, including man and marsupials, were included in it.

The attention of scientific men having been drawn to this curious parasite, they soon proved that each fluke produced a vast number of microscopic eggs, and that these were to be found in the gall and contents of the intestine, and that they passed into the outer world encased in the dung. What became of them afterwards no one for a long time could say.

Years went by; microscopes were improved, and became more numerous; and at last some acute observers began to remark on the similarity in form of certain so-called animalcules found in snails to the younger stages of fluke found in sheep's livers. Later on, the same and other new observers attracted to the subject found that these animalculæ in the snail were the progeny of other animalculæ, also found in the snail, and that these latter again came from another animalcule to be sometimes found swimming free in the water of the pools where the snails abounded. All these discoveries, however, were so novel and bizarre that there was a long period of waiting

before the facts became widely accepted. What wonder that doubt arose when a few naturalists announced a series of generations so astonishing that it would hardly be more remarkable to say that a horse had begotten a cow, which in turn had given birth to a goat! Yet it turned out that the pioneers were right, and that the fluke in the liver of the sheep was in reality the descendant, two or three generations removed, of the microscopic animalcule that danced and whirled merrily along in the pools of the sheep pasture.

Finally, the whole matter was cleared up—at least, so it was thought. The eggs of the sheep-fluke taken from dung were artificially hatched, the young were given a chance to penetrate certain species of snails. There they went through their remarkable metamorphosis, came out again, and encysted themselves on the surface of grass, where they were ready to be taken in by any unfortunate sheep that happened along. Once in the sheep's stomach the young fluke was not long in finding its way to the liver, where it took up its abode, and customarily lived to a happy old age, much, however, to the detriment of the unfortunate sheep.

Fig. 6.—Portion of the liver of a sheep, natural size. *a*, liver; *b b b*, gall bladder; *c c*, enlarged duct cut open to show the appearance of the parasites known as fluke; these latter are seen at *e e* crawling forth from the various branch ducts exposed, and also at *d d*.

Such in brief is the life history of the sheep-fluke—a history which, though it may now be told by any school-boy in a few flippant words, yet required the thought and work of scores of able men of science in our and the preceding century to establish. Let us not forget to render its due to the memory of these men, who, it is safe to say, never received in their own time any other reward than the grateful remembrance of a few pupils in their

favourite studies, and who are now for the most part beyond the reach of any honors, except those which we pay to the illustrious dead.

While profiting from their discoveries let us not forget who are our benefactors.*

The Sheep-fluke in Australia.

A country swarming with sheep, like Australia, was sure, sooner or later, to suffer from the ravages of the sheep-fluke. From times early in the history of the country down to the present, losses of sheep from this pest have been frequent, especially in certain districts.

It is not the intention here to more than hint at the history of the sheep-fluke in Australia. The reader will perhaps be content with the bare statement that could the losses from this pest be all recovered they would far more than pay the national debt of all Australasia.

It is much more the author's present purpose to ask whether the peculiar conditions of Australia have given rise to any new problems in connection with this pest, and, if so, whether these problems are soluble, and to state a few of the results of his own observations.

Whether Australian conditions have given rise to new problems in connection with the life history of the sheep-fluke is a question that rose prominently in my mind after my inquiry into the life-history of the Australian wheat-rust.† The parallel between the life-histories of rust and fluke, notwithstanding the fact that one is an animal parasitic in other animals, and the other a plant parasitic in other plants, is so curious, and, I venture to think, so instructive, as to deserve consideration.

The fungus commonly known as wheat rust is found in Europe to pass one of the stages of its existence in the tissues of the leaves of the barberry bush. In this latter situation its full growth is attended with the production of two sorts of spores, and these two sorts of spores have given rise in some quarters to the opinion that the fungus in this form is a complete organism in which a sexual reproduction is possible—witness the words spermogonia and spermatia applied to the so-called male organs and sporidia respectively; at any rate, whether this view be entertained or not, no one, I venture to say, will deny that the rust-fungus reaches one of its highest stages of development in the form in which it appears in the tissues of the barberry-bush, and this is entirely sufficient for the purposes of our parallel. The spores of the barberry-leaf-form of rust alighting on the blades of wheat produce a second generation unlike the first, and the spores of this second generation again, later in the season, give rise to a third generation unlike the second, and finally the third generation produces the following spring a fourth, which, when used to infect the barberry-bushes produces the original barberry-rust.

Now, this cycle of generations is as remarkable as that of the sheep-fluke, and curiously like it in a variety of ways. I do not wish to make too much of this analogy, for it is well-known that analogy is often very misleading; but I may justly call attention to the following fact, and with it point a moral. My investigations have conclusively shown that, although the above is a correct sketch of the life history of the wheat-rust in Europe, it is not correct for Australia. There are few barberry-bushes in Australia, and on the few that exist no barberry-rust has ever been seen, from which we can only draw the conclusion that the barberry-rust either does not occur in

* Wagener, Bojanus, von Baer, Steenstrup, de Filippi, Moulinié, de la Valette, Leuckart, Thomas, and many others. † Puccinia graminis.

Australia, or is very rare. We are thus driven to the conclusion, now accepted by all scientists in Australia, I believe, that wheat-rust with us habitually *omits one or more of its common European stages.*

It will be no matter for wonder to the reader that after having established the above fact I should be prepared to discover a similar fact in the case of the sheep-fluke, an organisation whose life history is analagous in its complications.

Fig. 7.—A snail that acts as intermediate host of the sheep-fluke in Australia. These are figured from the specimens in which the Australian intermediate stage of the sheep-fluke was first discovered at Austermere, Moss Vale, 1893. Mr. Hedley, of the Australian Museum, determined the species of snail to be *Bulinus Brazieri.*

For a long time this suspicion seemed to be supported by my investigations. Australian snails were searched in vain for intermediate forms of the fluke. No observer had ever seen such a thing. Time passed, and still no intermediate form could be found. At last, however, about four years ago, snails containing the intermediate form of some species of fluke, presumably sheep-fluke, were found, and upon careful examination and measurement were found to be indeed the long searched for intermediate form. Accordingly, after thorough study and comparison at intervals lasting through nearly two years, the formal announcement of the discovery was made. The Australian snail harbouring the sheep-fluke turned out to be a different species from the European snail performing the corresponding function. Submitted to competent authorities it was pronounced to be the species *Bulinus Brazieri*, a common and well-known snail whose likeness is herewith presented.

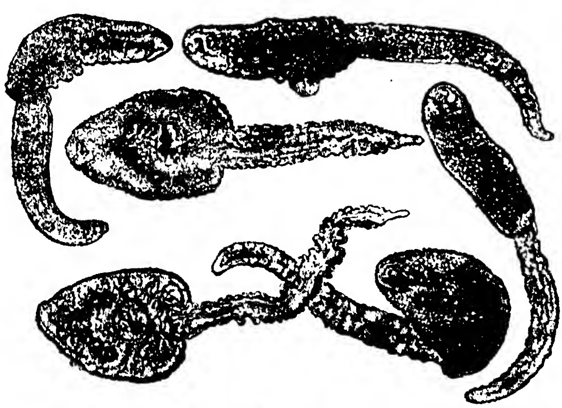


Fig. 8.—Specimens of the cercaria or tad-pole-like intermediate form of the sheep-fluke found in the snails shown in Fig. 7. These are shown in various natural attitudes, as seen with the microscope. The mouth is well forward, and may be seen in the upper left-hand figures. The large circular ventral sucker is also seen best in the left-hand illustrations. The power to protrude the sucker is indicated in the upper profiles. The drawings are faithful reproductions of the author's original photographs taken in 1893.

This snail may be found, sometimes very plentifully, on the stems of plants growing in fresh water, as well as on other objects above or below the surface of the water. They are essentially fresh water or rather amphibious snails, never being found in an active condition very far from their aquatic home.

A single snail of this species will often harbour several hundred of the *redia* or *cercaria*, as the two intermediate forms of the fluke are respectively termed, a fact which is in accord with those recorded in case of the corresponding European snail.

Such, in brief, is the story of the discovery of the Australian intermediate host of the sheep fluke, a narrative which, in its proper place in these pages, will be again adverted to and enlarged upon. By this discovery, the suspicions of European naturalists that the Australian intermediate host might prove to be another species of snail than that which serves in Europe were confirmed, and the doubts as to whether there was in Australia any intermediate host were cleared up.

It may be permitted us to doubt, however, whether this discovery, satisfactory as it undoubtedly is, goes far enough to warrant us in saying the life-history of the Australian sheep-fluke is essentially identical with that of the European form. There are still many points upon which evidence is wanting before such a statement will have the full warrant of science.

At this point it will be well to state that redia and cercaria are common in a wide variety of molluscs, there being probably no less than a hundred different species of such intermediate forms already known, many offering a most striking resemblance to those of the sheep-fluke. The mere discovery of such forms in a snail is, therefore, very far from being a proof that the snail harbours the intermediate form of the sheep-fluke.

The foregoing remarks allow us to proceed profitably to a consideration of the preventive and remedial measures that may be successfully adopted by Australian sheep-graziers.

Remedies and Preventive Measures.

The various remedies and preventive measures which I shall propose are based on our knowledge of the life-history of the sheep-fluke, as narrated in the foregoing pages. After the reader has perused these proposals he will, I think, agree with those who set a high value on the abstruse and difficult scientific researches that have slowly led up to our present knowledge of the nature and phases of the fluke. It will be seen that each remedy is based on some fact in the life-history of the fluke—some fact that has become known solely through the agency of scientific research. As this thought comes home to us it inevitably raises the question, "Who are those investigators who have wrestled so patiently and successfully with this dark problem?" Reader, it would lead too far afield if I should attempt only to name and locate them. Many of them are dead—most of them are unknown and unappreciated beyond a narrow circle of friends, while all of them have gone practically unrewarded. How pathetic it is to compare the great reward a later generation would willingly lavish on a discoverer or inventor with the pittance meted out by his contemporaries, and how short-sighted and poor-spirited are we, to be moved by such a noble impulse towards the distant and dead, yet forget that we ourselves may be playing the very part of those mean old contemporaries.

It must be remembered that in dealing with remedies we are obliged to mention all the various ways in which the fluke evil may be mitigated. No person will, perhaps, be able to adopt all of the following suggestions; nevertheless, none of them are without their uses. Again, no one of them is alone a sufficient precaution. So far as possible they should be all adopted concertedly.

Burning.

Burning off grazing land has become a well-recognised method of "cleaning" it. The reason for the operation is very simple, and it is this: Any small organisms clinging to the herbage, such as the eggs and larvæ of parasites, will be killed by the fire. While this supposition is in the main true, it is well to know whether, and in what way, burning may fail to "clean" the land. So far as fluke is concerned, we have to consider the chances the eggs and larval stages have of escaping the conflagration, and it may be said at once that the chances are by no means few. Most of the eggs that exist in green dung will be left unharmed. Though the surface of the pellets may be scorched, the heat will not penetrate them sufficiently to kill all the fluke eggs they may contain. Moreover, all the excrement lying on bare paths will remain unscorched. Again such excrement as lies in damp places or among incombustible material such as green grass will also escape the fire. When we recollect that it is only from comparatively fresh dung lying in or near water, or at least where it will sooner or later be moved into water, that fluke may be expected to develop, we shall be easily convinced that fire is by no means so cleansing as Australian sheep-owners are wont to believe. The fire cleanses, to a certain extent, so far as it goes; the difficulty is that *the places where it won't go are the very places most requiring to be cleansed.*

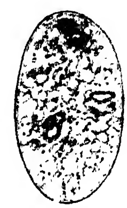


Fig. 9.—Egg of sheep-fluke as found in sheep-dung, and seen with the microscope.

Fire should be applied and controlled, not left to accident and allowed to take its own wild course. The sheep-owner who is able, during a time of drought, to burn off his low-lying and swampy places will reap the greatest benefit, and such a course can occasionally be adopted by those who plan for it a sufficient time in advance. Even when most successfully carried out, however, there can be no hope that the fluke will be eradicated. Some, possibly many, eggs, cysts, and snails will be killed; but it is equally true that some will remain to multiply and infest the stock as before.

We must conclude, therefore, that while fire may be made under favourable conditions to ameliorate the fluke trouble for a few months, it cannot be relied upon alone to successfully combat the disease, and that only when utilised in time of dryness and drought, and in conjunction with other measures, is it very effective.

It must not be forgotten that drought alone is sufficient to inflict great injury upon the eggs and larvæ of the fluke, and that this is the reason that sheep often do remarkably well for a season or two afterwards, so well indeed as to have given rise to the opinion among sheep-owners that a drought is not an unmitigated evil.

When burning off for fluke the wise pastoralist will not forget to take into account the effect of the fire upon his pasturage. Fire destroys seeds, which may be useful or baneful, according as they are those of good forage plants or of noxious weeds.

Overstocking.

This is a widely prevalent evil, which results, among other things, in increasing the abundance of fluke. It is very easy to see the reason for this. Overstocked land becomes close fed, so that stock have to nibble very

close to the ground, so close in some cases that they pull their food up by the roots. Such a method of feeding obliges the animal to run a greater risk of taking in the cysts of fluke, and we must add to this the weakened state of the digestion due to improper, and often insufficient, food. I have pointed out before, and may again here repeat, that it is beyond question that perfectly strong and healthy digestion is one of the greatest barriers any animal can set up against the invasion of such parasites as inhabit the digestive canal and its appendages, and which depend on gaining an entrance to the body through the stomach. If the digestive fluid is abundant, strong, and healthy, the chances are considerably against the parasite. On the other hand, a weak digestion is an open door to the parasite. Hence it is that, quite apart from the greater risk of infection through shortness of feed, overstocking is a dangerous practice.

It is well known that stock, more especially sheep, to a certain extent avoid the grasses and other fodder plants growing in swampy places, these plants being less palatable to them. Overstocking, however, often compels the animals to resort to the swampy places for food, when, of course, they run the greatest possible risk of taking in more fluke.

Again, we have to add to the foregoing risk the fact that overstocked pastures often reek with manure, and in consequence the eggs and young of the fluke soon become very abundant, being of course derived from the manure. The more stock, the more manure; the more manure, the more fluke-eggs from which to derive more fluke; the more stock, the more close feeding; the more close feeding, the more poor digestion and weakness, and the more resort to swampy areas; the more indigestion and the more resort to swampy areas, the more the stock become infested from their own superabundant dung. The more fluke the more weakness, the more weakness the more fluke—and so the weary tale goes on, and when the poor animals drop to rise no more, the owner who has overstocked his run is himself largely to blame.

Treatment of Young Sheep.

The losses from fluke depend largely on the manner in which young sheep are treated. Young sheep suffer more from a given number of fluke in the liver than do older sheep. One-quarter the number of fluke that an old sheep would bear with equanimity would kill a lamb. If, therefore, lambs and weaners can be kept comparatively free from fluke a great point is gained. I can never quite conceal my astonishment that this fact is not acted on, and I can only conclude that it is not generally known. The whole case may be briefly stated by saying that whatever regulation can be adopted with benefit to the whole flock will be of even greater benefit to the lambs. Give the lambs the best food, the pick of the paddocks, and be especially careful to keep them away from wet and flukey places. Run no risk with lambs, is the golden rule for the prevention of deaths from fluke.

Water, Water-sheds, Dams, Swamps, Drainage.

There is no fact more firmly established than that fluke require water for their development. All fluke are derived from fluke-eggs found in dung; but these eggs can hatch and develop only in the presence of moisture. The measures I would recommend against fluke are based very largely on these two fundamental facts: Keep the dung away from moisture, and you will have no fluke; keep half the dung away from moisture, and you will have

much less fluke. The management of water is, however, such a complex subject, that it requires to be treated under a variety of heads, such as drainage, watersheds, dams, swamps, &c.

Dams.

There are many objections to dams as ordinarily constructed for sheep in Australia, and some of these objections arise on account of the presence of fluke. The water of any dam to which flukey sheep are given free access will soon contain the free-swimming embryos of the fluke. Sheep-dung containing the live eggs of fluke readily finds its way into the water, and the eggs then soon hatch. It is in this way that the water becomes first contaminated; all the other stages in the history of the fluke follow on naturally enough. So far as dams are concerned, the spread of fluke could be practically prevented by keeping the water free of dung. Now this is a matter to which no attention is paid, largely, I presume, because it is considered not to be feasible.

Let us see.

Few realise from how small an area of land a large dam or tank can be filled. Suppose the dimensions of the water basin of a dam be 2 x 25 x 25 yards—in other words, suppose the capacity of the dam be about 1,000 (to be exact, 1,250) cubic yards. If the annual rainfall be 24 inches, the rain that falls on an area 125 yards square would fill such a tank eight times full in one year. Or, to suppose a more common size, let the tank be 12 yards square and 6 feet deep, and thus contain about 300 cubic yards; then, with the same rainfall, the rain that falls on an area 60 yards square would fill the tank eight times in a year.

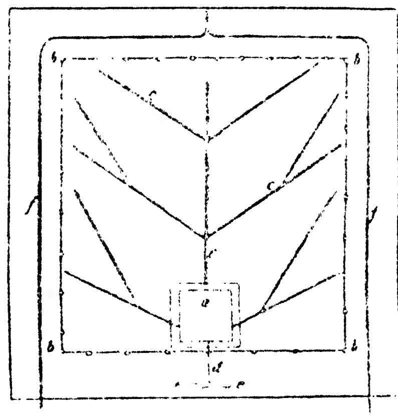


Fig. 10.—Diagram showing arrangement of water shed, races, tank, and trough such that a pure water supply is assured. The water-shed is fenced off by the fence *b b b b*. The races *f f* keep the ordinary drainage of the paddock from contaminating the water-shed. The ploughed races *c c c* empty into the tank *a*, from which the water is siphoned through the pipe *d* to the trough *e e*.

It is, of course, impossible to conserve all the water that falls on a given area of land, because a large part of it soaks in and is lost, so far as conservation is concerned, yet it is possible to collect a much larger portion of it than is commonly supposed, and that by a very inexpensive method—namely, the use of ploughed races or gutters. Again, it is needless to say, the proportion of water that can be collected from that which falls depends in a large measure on the nature of the rains; heavy showers producing much surface water, while drizzling rains almost wholly soak into the soil, leaving very little to drain into dams and tanks.

The arrangement of races that would drain a small watershed depends on the slope of the land, but in general will be somewhat as in Fig. 10, where *c*, *c*, *c*, are ploughed races leading to the tank, *a*. These may be single or double furrow, preferably the latter in most soils. They are made by

ploughing two furrows of suitable uniform depth (say) 8 inches, and scooping out the soil and piling it on the lower side of the race, to form a dyke, which increases the carrying capacity of the race.

It is better to locate the races by means of a surveyor's level, as when done "by eye" the races are commonly made unnecessarily steep. A very slight fall suffices if much rain falls, though a light rain is better handled in steep races. A fall of 1 foot in 100 can scarcely be detected by the eye, yet a race with that fall will carry water admirably when there is a good smart shower.

This matter of the fall in the races is one that will repay careful consideration in locating tanks, because upon it depends in no small degree every other detail of the tank.

It is usual to locate tanks in natural depressions—so usual that it seems to have become almost an accepted law that they cannot be located any-

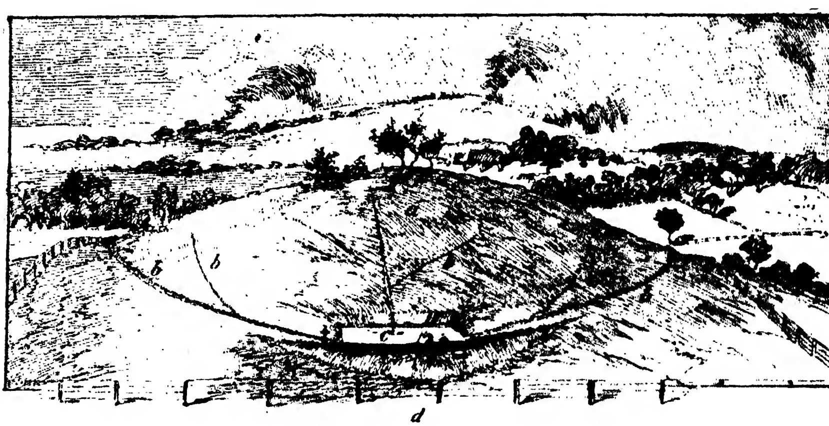


Fig. 11.—The ploughed races *a*, *b*, intercept the water from rain-storms, and run it into the tank *c*, whence it is siphoned into a trough near *d*, outside the fence.

where else. This is, however, a mistaken idea, and anyone having to locate tanks on a station, if he be not something of an engineer, would do well to study the works of competent engineers as illustrated in the water supply of the nearest large towns.

While a natural depression is a model location for a tank, it is not a necessity, and it must be remembered that to secure a suitable natural depression the pastoralist may have to place his tank in an otherwise very inconvenient or unhealthy position. The one necessary natural feature to a tank is a sufficient watershed. Given a sufficient watershed, the remaining features are a matter of engineering, and by engineering I do not mean scientific engineering, but simply taking carefully into account the simple fact that water runs downhill, and this other hardly less obvious fact, that it is better to store water at an elevation than in the lowest places.

However obvious these two principles may seem to the reader, I can assure him that they are very largely disregarded throughout this Colony in constructing tanks for watering stock, for it seems to be regarded as essential to place these tanks in the lowest possible places, and the axiom that water runs downhill seems to be accepted only in case the hill is steep.

This article cannot be devoted to engineering, but a few suggestive illustrations are added to show how a watershed may be secured in various situations where there is no natural hollow. The simplest case is shown in Fig. 11, where the water on a uniform slope is gathered into a tank by simple

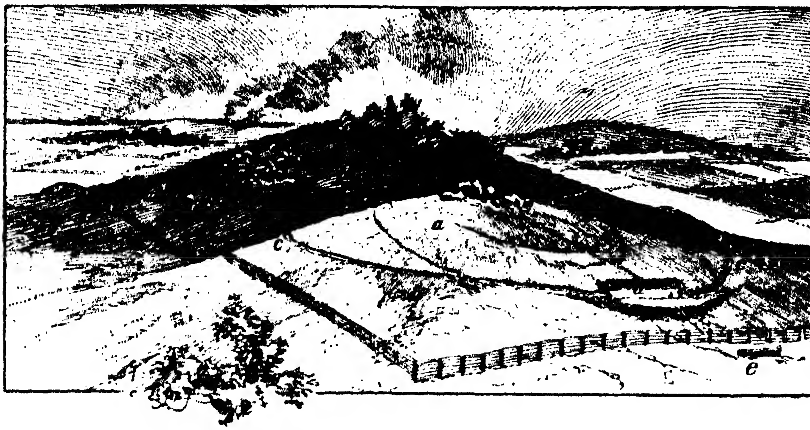


Fig. 12.—A tank, *d*, is filled from races running round the two hills *a* and *b*. The tank-water is then siphoned into the trough *e*.

forked races. A second case, Fig. 12, is less simple, showing how water naturally running away from the tank may be turned to account. An apology seems almost necessary for introducing explanations of such simple

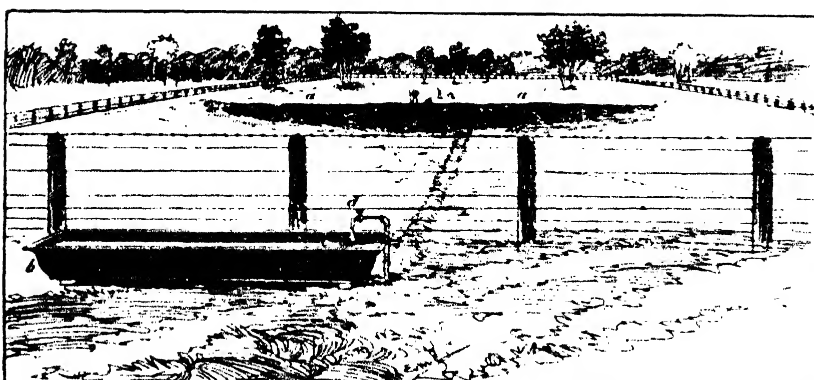


Fig. 13.—The water in the dam *a a* is caught on the fenced-off area shown, and then siphoned by means of galvanised piping into the trough *b*. The hollow floating ball *c* opens and closes the tap *d* automatically. In practice, the parts *c* and *d* would be boxed in. The same trough can be made to serve several paddocks which corner together, by placing it under the fence.

devices, and it may be found in the general disregard with which these methods meet among pastoralists.

Having now outlined some of the principles by means of which a tank may be located almost at will, at least in hilly or undulating country, let us see what advantages may accrue from this choice. Foremost among these is the ability to keep the water free from the larvæ of parasites. This may be done

by reducing the area of the watershed and fencing it in so that no dung is ever allowed to contaminate the water. The larvæ of these ubiquitous creatures may, it is true, be blown into the water by winds, but this will be a comparatively rare occurrence. A secondary advantage is that the tank may be placed in an otherwise healthy locality, which is accessible to the stock with a minimum of labour. Instead of compelling the stock to go to the lowest part of the paddock, located, it may be, a mile or two distant in an out-of-the-way, wet, and, therefore, dangerous place, their vital forces could be economised by placing the tank in a healthy spot, readily accessible from all parts of the paddock with a minimum of labour, at a central position and a medium level.

Water fenced off from stock may be led out into a trough by means of a pipe and what is known as a ball-cock, *i.e.*, a cock worked by a hollow copper ball floating on the surface of the water. When the water in the trough gets low, the lowering of the floating ball opens the cock and admits water,

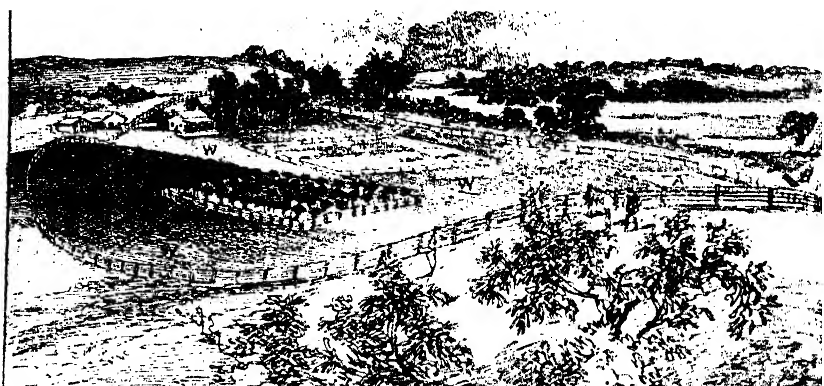


Fig. 14.—Showing a tank, A, whose water-shed, W W W, is fenced off and kept free of stock. The water is siphoned off into the trough B located in the stock paddock.

which, gradually rising, again raises the ball and shuts off the supply. Thus in Fig. 14, the tank A, filled from the fenced-in watershed W, W, W, might have its water siphoned into a trough located at B. The plan of the pipe and trough is shown in Fig. 10, and again in Fig. 13.

Drainage from Camps and Licks.

The pastoralist may frequently with advantage pay more careful attention to the drainage from sheep-camps and salt-licks. These places are much frequented by the stock, and in consequence much manure becomes collected about them. This, of course, means that the eggs of fluke and other parasites of the alimentary canal or its appendages are more numerous here than elsewhere. The tramping of the stock having worn the land bare and smooth for considerable distances roundabout, the water of rain-storms quickly forms rivulets capable of washing these eggs into lower places, where in pools, dams, and streams, they find the conditions requisite for their further development.

The drainage of these places may sometimes be brought under control at a very moderate cost. Races or gutters may be either ploughed or dug, and

so placed as to receive the objectionable drainage and lead it away to places where it can do no harm. If the drainage be conducted outside the stock-paddock so much fertilizer is, of course, lost; but it is better to suffer this loss than a greater one.

This matter of the drainage from sheep-camps is mentioned more particularly because it is not uncommon to see these camps located so as to drain

Fig. 15.—Sheep camp *a a*, and salt trough *b b*, showing how races *c c* could be located to catch the dangerous drainage and conduct it away to a safe place, when otherwise it would contaminate the pasturage of the paddock.

into swampy land, and this combination forms a very perfect incubator for fluke; in fact, it is doubtful if a very much better arrangement could be devised for the propagation of fluke on a large scale. If the stock-owner objects to the loss of manure that would result from conducting the drainage outside his grazing area, he might at least so divert the drainage as to bring it on to the drier parts of his land, instead of allowing it to find a natural lodgment in some swamp, or dam, or water-hole.

I have designed Fig. 15 so as to present these ideas in a more graphic way.

Fence off Swampy Places.

In many parts of the country there are few ways in which more sheep could be prevented from becoming flukey for a given sum of money than by fencing in the swampy areas that serve as natural breeding-places for the fluke. Along the margins of rivers and creeks are found numerous areas of land that are either perennially or periodically "dangerous." By concentrating his attention on these areas the pastoralist may often save himself from very serious losses.

Perennial swamps, if they cannot be drained, can at least be fenced in. Land that is only periodically wet or submerged, if also fenced off so as to be under control so far as grazing is concerned, will very often in the long run be more profitable, for whenever on account of continued rain it becomes "dangerous," *i.e.*, flukey, it can be given a rest, or pastured with the stock

least subject to fluke. Even should the fencing-off result only in ability to keep the young sheep off the infested areas the gain would sometimes—nay, in flukey country, often—far more than pay the interest on the outlay necessary for fencing.

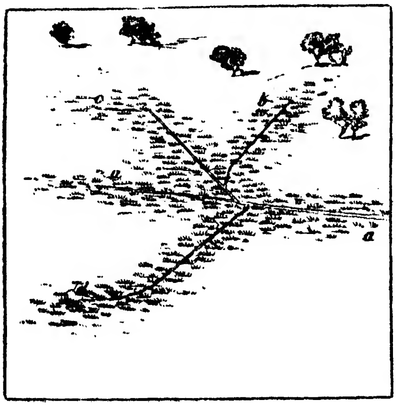


Fig. 16.—Swampy paddock, showing where surface drains, *a*, *b*, *c*, *d*, should be located so as to drain away superfluous moisture that would favour the growth of snails.

Fig. 17.—Square paddock, one corner of which, *a*, has been fenced off on account of its swampy, *i.e.*, dangerous, character.

In laying out a run, the cost of fencing so as to avoid risk from fluke, would ofttimes be no greater than that ordinarily incurred where no attention is given to such matters.

Fig. 18.—Swampy areas A and B fenced off from the safe paddocks P P. There are hundreds of fluke-infested sheep runs in the colder and moister parts of the Colony where the fencing off of these swamps, located on the border of rivers and creeks, would be a paying investment.

Figs. 16, 17, and 18 give pictorial form to some of the suggestions made in the text.

Rotation of Stock.

We often hear of the rotation of crops, but almost never of the rotation of stock; yet where it can be accomplished the rotation of stock is a very good practice. By rotation of stock, I mean the pasturing on the same paddock one after another different kinds of stock. Thus, sheep for a time, followed by horses, and these latter followed again by bullocks. In this place it is only necessary to take note of the advantages derived in decreasing the amount of loss from fluke.

In general each species of animal has its own particular parasites, so that the parasites found in the sheep are not found in the ox, while the parasites of both differ from those of the horse. There are, however, exceptions to this rule. Thus the fluke is found in both the sheep and ox, as well as many other animals. In such an exceptional case, nevertheless, it nearly always occurs that the parasite is very much more common in one of the hosts than in any of the others. As an instance of this, it may be remarked that fluke is very much less common in bullocks than in sheep. In other words, the sheep is the chief host of the fluke.

It is obvious, therefore, that a paddock that has become flukey under sheep may be improved by turning in stock which harbour fluke to a less degree than does the sheep. Bullocks following flukey sheep will, of course, pick up fluke, but fewer of these will come to maturity, and henceforth so long as bullocks continue to occupy the paddock the amount of fluke-eggs will diminish until the paddock would be again fairly safe for sheep. The following rotation may therefore be recommended for a flukey paddock :—

1.—*Good.*	2.—*Better.*	3.—*Better still.*
Sheep,	Sheep,	Sheep,
Bullocks,	Horses,	Horses,
Sheep,	Sheep,	Bullocks,
&c.	&c.	Horses,
		Sheep,
		&c.

The length of time for which each kind of stock should be allowed to occupy the paddock depends on the season, and more particularly on the life-history of the fluke. An entire season, or even two, would be the safest rule to follow, but this, of course, would in many cases be out of the question. In any case the rotation should be arranged so as to bring on the sheep in the dry times if possible.

The foregoing ideas occurred also to the late Dr. Bancroft, of Brisbane, though whether his conception antedates mine I must leave in doubt; for while he first placed them in print in one of the Queensland newspapers, I had at an earlier date also publicly expressed them. Furthermore, it is quite possible, so obvious are they, that these ideas may have originated also with previous writers; but if so, the fact has escaped me, and indeed cannot, I think, be well known. There can be no doubt that some form of systematic rotation could be followed with advantage by many pastoralists. Even if rotation is impracticable on all paddocks, it might be applied on those most liable to disease.

Of course the value of these suggestions is very much enhanced by the fact that they apply to other diseases than fluke, as I shall point out in my general report.

Some of the relations of the Australian Fauna to the Fluke-pest.

Has the sheep-fluke any enemies or friends among our native birds and animals? Do any of our native animals harbor the fluke? Do any of them prey upon it? Can we derive any benefit from any of these relationships? These are questions which I have sought, gun in hand, to answer, and with such good effect that I am able to lay before the reader records of facts both interesting and valuable. The indigenous birds and animals and those introduced from Europe have been carefully examined as they occurred in fluke-infested districts, and record made of their habits, their food, and their parasites. As soon as I had discovered that one of our native snails harbored the intermediate form of the sheep-fluke, the question, "What enemies has this snail?" became important enough to demand special notice, and as I have been fortunate enough to obtain at least a partial answer to this question through observations on native birds, I will begin the account of the relations of the Australian fauna to the fluke-pest by an account of some of these feathered friends.

"These are questions I have sought, gun in hand, to answer."

"Introduced from Europe."

The Mud-lark and other Snail-eating Birds.

Through nearly the whole of Australia the vicinity of fresh water is enlivened by the presence of the Magpie-lark or Pee-wee, a bird of such considerable size, and such striking black and white plumage, of such engaging manners, and such common occurrence, as to have secured, not only the attention, but also the kind regard of all our country people.

Let us add at once that the cold and critical scrutiny of science not only confirms the favourable impression this bird's appearance and good manners have created, but even heightens his reputation by proving him to be a great benefactor. From being reckoned a rather useless member of the feathered world, our investigations have placed him in the category of the most useful; and as this promotion arose almost solely from an examination into the food-habits of the bird, it may not be thought out of place if we set still another example of a method of studying birds that is now-a-days all too rare.

THE COMMON MUD-LARK OR PEE-WEE.

NATURAL SIZE.

(Also called Magpie Lark.)

We require to know much more about the habits of the common birds in their relation to man. Grant that the feathering of rare birds is a very interesting study, still it sinks into insignificance when compared with the careful investigation of the history and habits of the commonest birds. The slightest trait of a very common bird is worth much more study than the whole plumage and anatomy of many of the rare specimens on the possession and description of which ornithologists so often pride themselves. To teach the people to take a genuine and intelligent interest in the most common birds is certainly a useful and dignified calling, and at the same time a scientific one; indeed the single examination into the food-habits of a bird demands a high degree of acumen and a wide knowledge of biology, especially of morphology. The exact nature of a wild bird's food can be best discovered by searching a large number of their stomachs during various seasons in various localities, and anyone who has attempted to identify the half-digested food-remnants found in such a search will readily agree to my high estimate of the ability required in studying the food-habits of birds. To be able to say at once to what species of beetle this elytron belongs, to what plant these are the seeds, to what caterpillar this head belongs; to be able to say not only whether this half-digested bone belongs to a fish, bird, reptile, or small mammal, but what fish, what bird, what reptile, what mammal, requires scientific ability of no common order; and yet even this is only the beginning of the research—the A B C of the matter.

The mess-tent, departmental camp, Bong Bong.

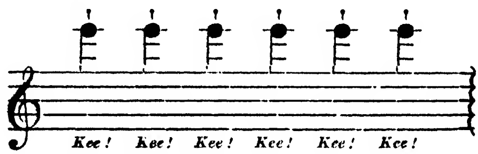
Appealing to ornithologists to give more of their attention to the habits of our commonest birds is, of course, asking them to grapple with a much more difficult task than counting spots and measuring wings, but would they not find their reward in the superior value of the results, whether considered economically or in a pure scientific spirit, as well as in the keen interest that would be almost universally taken in such researches?

The Australian naturalist who first goes into the bush animated with the ambition to completely portray our common birds in common language—to enter into their humours and to understand their characters, to emulate in a more modern form White, Burroughs, Brehm—will reap a rich harvest if he bring to his task the requisite ability. But we must return to our subject.

The heavy, ungainly flight of the Pee-wee proclaims the air to be not his favourite element. Flap, flap, flap, he laboriously moves along, strikingly in contrast with the graceful arrowy movement of the magpie, particularly as he moves his rounded wings at right angles to his line of flight, while the magpie seems almost to be leaving the tips of his wings behind him.

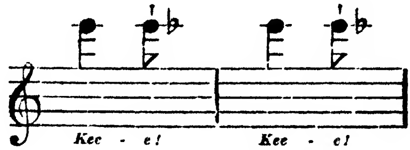
On his feet, however, the Pee-wee is completely at home, and his walk, whether on the ground or along the limb of a tree, is sprightly and vivacious,

playing a somewhat self-confident elegance, that makes up for his slow and awkward flight. I have observed that in walking his head has something of the movement characteristic of wading birds, and indeed he is a kind of semi-wader, often walking in water ankle-deep, among aquatic plants along river-banks and in bogs. At all such times he is very alert, and it is difficult to get a good view of him, except through a telescope. He spies me at a distance, and flies up into an adjacent tree, often taking the precaution to fly beyond the tree, and come back into it on the far side, with a kind of swooping curve. He likes to see all sides of a tree before he ventures in. "*Look before you 'light*" is his motto. Like a true comrade, he warns his mates of my presence by a peculiarly-accented call, "*Kee, kee, kee, kee, kee, kee*, pitched about thus,



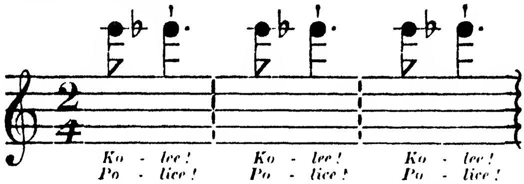
It is remarkable how much a bird can do with a simple note or two. Quite a vocabulary is made out of it, suggesting that the step from bird language to that of savages is scarcely greater than from the language of savages to that of civilisation. As, however, one syllable can be repeated slowly or quickly, with a rising or falling inflection, loudly or softly, once, twice, thrice, or many times in succession, it is easy to understand how, even where their notes are limited in number, birds manage to talk among themselves indifferently well.

The Pee-wee is not a singer—he is a talker. Lingering near his haunts, the close observer soon learns that his notes are not mere caprice. He has ideas, and he has learned how to express them with a single syllable. It is difficult to decide whether this syllable is "kee" or "tee," but suppose the former. Then "*Kee-e-kee*" seems to be a mere casual, unconcerned cry, signifying as it were, "*Here I am*," "*All right*." Excitement, either through alarm or sport, is expressed thus "*Kee, kee, kee*," or "*Kee, kee, kee, kee, kee, kee*," many times repeated. This is not, however, the only syllable used by our favourite. "Ko-lee" is another and a playful note. One bird being sportively chased by another, sings out "*Ko-lee! Ko-lee!*" much as if jokingly calling for the "*Police! Police!*" A single gurgling note, "Igl," has the quality of the magpie's song. "Kee," however, is the basis of the language, and is pitched near E, though this varies with different individuals, and even in the same individual it rises or falls somewhat less than a semitone, according to the desired meaning. Thus,

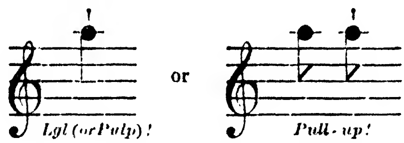


is emphatic, and calls for attention or denotes alarm, the second note having a falling inflection and accented, as if in a final effort of expulsion. Similarly, the single syllable "kee" may become "kee-eh," in which the second

part is sharpened half a tone. In the playful note "ko-lee" the order of the tones is reversed, as follows:—



The syllable "Igl," or "pulp," or "pull-up," is pitched lower:—



All these various notes, of course, have their special meaning according to the occasion on which they are used, but they are rarely uttered from the ground. Conversation is carried on during flight as well as when the birds are perched on a tree or fence, or even while sitting on the eggs or brooding the young.

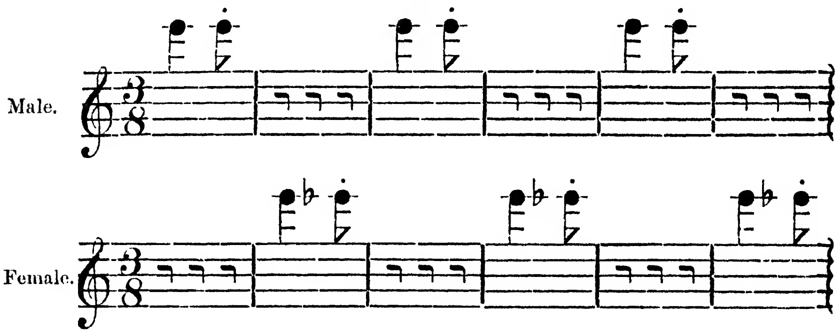
When he is terrified, our poor little friend is a pitiable sight. His wings raised and trembling with excitement, his voice goes up about an octave, and his cries are loud and in quick succession. This alarm will summon other birds, such as the soldier-bird and magpie. I have observed that this cry of terror is common to a number of species, and this is probably due to the fact that these species have some enemies and sources of danger in common.

It will doubtless excite the reader's amusement to be told that these birds perform accurately-timed duets. This trait is well developed among Australian birds and frogs; in fact, I do not remember to have heard in any other part of the world such good examples of this phenomenon. Witness the comic responsive duet of the Australian Butcher-bird and his wife. Says he, "*What do you drink when you go on a drunk?*" "*Water, water,*" invariably responds his wife, with an ironical and very comical upward inflection. "*Oi'll tell yer father,*" says he in a rich brogue, upon which she calls for "*Quarter, quarter.*"

Of course, these words and meanings are an imagination of the mere human audience, but of the responsive duet there can be no doubt.

Pee-wee duets are much simpler, but no less marked. The female calls out in a somewhat weaker voice, and less than half a tone flatter than her mate:—

Or the duet sometimes occurs in this form :—



The cause of these interchanges of sound is no doubt oft-times the precaution taken by each bird to make known his whereabouts to his mates, and to assure them of his safety, but they cannot always be explained on this simple assumption, as, for instance, during nest-building, and on some other occasions.

Nesting takes place during October, November, and December, at which season the birds gravitate toward rivers and tanks, the nest being seldom far from water, and usually located in the side of the tree nearest some creek or water-hole, often on a limb overhanging the water. From 5 to 80 feet above the ground on a horizontal or gently sloping limb, often at a fork, built substantially of mud, with no effort at concealment, the nest is typical of its owner—simple, frank, substantial. Any approach to a tree where nest-building is going on is a signal for the birds to silently depart, and they will not return until all seems quiet. If one goes under the tree and remains there for some time, the birds at last become uneasy, and at intervals fly near, hover and wheel overhead for a few seconds crying out, and then again disappear.

"At one time during my strolls"

Both sexes take part in building, the male being quite as industrious and expert as the female. The mud and straw (decayed grass or sedge) culms are brought in masses as large as the end of one's finger. The trip and back of (say) 100 yards takes only thirty seconds. The work of building consists in laying the load on and then distributing it. The latter requires skill in treading the top down, and weaving in the projecting straws. The weaving in is done with the beak, which is worked along the edge of the masonry, seizing any projecting straws and by a quick twist turning them against the mud, where they adhere. If by chance any straw is too stiff and repeatedly fails to adhere, and obstinately sticks out, it is pulled out and discarded, the surface of the masonry being thus kept constantly free of projecting straws as the work progresses. When complete the nest is cup-shaped, hemispherical, 5 to 6 inches across and 3 inches deep, and often resembles a knot or excrescence on the limb, the

resemblance being sometimes heightened by the similarity in colour. The lining consists of a few straws, and occasionally a feather or two.

At one time during my strolls I entertained myself making some observations on these birds, extending over some weeks off and on, when to my delight a pair of them were so accommodating as to come and build within sight of my laboratory window, as much as to say, "Go-lee! go-lee! You needn't squander such a lot of time spying into the secrets of Pee-weedom. We're going to take pity on you, and show you the whole family history. Go-lee! go-lee!"

I am not quite sure that this is a perfectly frank statement of the case, for I suspect that this particular pair of birds came from a certain willow-tree where during the previous fortnight a succession of tragedies had taken place. A nest had been completed in this willow before my attention was attracted. Matters went on well for a day or two, until one morning the nest was missing; only the basement remained. Who or what the marauder was that tumbled the nest into the water below I could not make out—perhaps it was the wind, which blew strongly those days. These were young and inexperienced birds may be, for I suspect that the older and wiser heads among them build on higher and more inaccessible limbs. This disheartening disaster, however, did not discourage my birds; they began another nest in the same tree, higher up and farther out over the water, thinking no doubt the new location would be free from danger. But, alas! No sooner was the nest done, and one egg laid, than another misfortune befel. The nest stayed well enough this time—it was the egg that went a-missing! I strongly suspected a Butcher-bird that I saw hanging about the neighbourhood, but as I could not fetch the matter home to him I forebore the retribution I have little doubt he deserved. I deliberated a few seconds along the barrel of my gun, but lowered it without pulling the trigger. The Pee-wees loitered about for a day or two longer, hesitating to try fortune again in the fatal willow, and then disappeared.

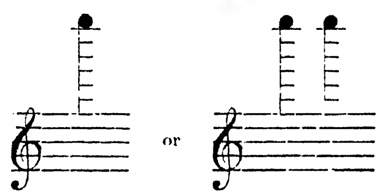
It was their disappearance from the willow region that marked the advent of my study-window pair, and very likely this was the same unfortunate pair. Their misfortunes appealed to me, and I determined to stand by them in their new venture, seeing that they had, as it were, observed my interest in their affairs, and appealed in this direct manner to my protection.

This time, as if taught by sad experience, they located the nest fully 60 feet from the ground. They did not consult me in this, and I did not understand their language sufficiently well to protest. I would have much preferred a better view of the proceedings, and should have urged that my protection would be somewhat in inverse ratio to their distance from the ground, and I should have argued that in an emergency it would be risky for me to trust my 12 stone weight on so small a bough at such a dizzy height.

However, the nest grew apace. The first day only a little cement of mud was plastered into a fork and along two small branches for a few inches. By night-fall the only indication of a result to a mundane observer was what appeared to be a daub of blackish paint on the grey, smooth-barked boughs. The second day this daub grew to the size of a hen's egg.

Both birds worked industriously, but it was clear that the male took charge of affairs, and plainly thought he knew more about building a house than his wife did. A lady friend remarks to me, with sly sarcasm, that she thinks this is characteristic of males. Frankly, I agree with her fully when she says that women ought to, and often do, know more about domestic architecture than men, and I pause to wonder "Why in the name of domestic bliss, are'nt there more woman architects?" Well, Pee-wees evidently

hav'nt advanced in this line any farther than mankind has. I must say that Mr. Pee-wee had occasionally some cause for complaint, for the wife did sometimes drop unconscionably large pieces of mortar, which went tumbling pell-mell to the ground. On such occasions he would rush at her and drive her off the bough with actions that said as plain as words, "Here, you're a duffer at that business; let me do it! You go along and bring some more mud!" which she generally did. When she was gone he would sing out occasionally in a high whistle as he plastered away. I fully believe he was calling to her for more mud or straw, as the case might require. "Mud!" he seemed to call, as he paused for a second to inspect his work, or "Straw! Straw!" Occasionally, when both were present at the nest, it was most amusing to hear the male twitter as he stooped over the work, calling his sweetheart's attention to the beautiful progress they were making. This twitter, which I never heard on any other occasion, resembled that of the swallow, only it was not quite so highly agreeable. "Look, dear, how fine its getting on. It'll be a nest in no time! Let's rush for some more mud!" and off they would go, and be back again in half-a-minute, each with a load of mud. While at work building, either bird, but particularly the male, often whistles once or twice a note an octave higher than the ordinary call, thus:—



to which the mate sometimes answers in the same tone, but more often an octave lower. This whistle is one particularly connected with nesting and brooding, though I believe it to be the same note that is repeated in rapid succession when the birds are extremely terrified; it also occurs as a distinct over-tone in the ordinary call in building. As I have before said, the beak is used as a trowel, and it is frequently wiped on the limb just beyond the bounds of the nest. This is the origin of the muddy markings invariably seen near the nest. The mud composing the bottom of the nest is invariably packed down by treading with the feet.

When the nest is completed, which is often in three or four days, it is allowed to dry and harden before the eggs are laid. From this time on the birds show admirable precaution when approaching the nest. On entering the tree they alight on the outskirts, and tarry a few seconds or a minute, then make a nearer approach, tarrying once more; and finally alight on the edge of the nest, which is used as a door-step.

The eggs are laid in quick succession—four or five eggs are laid in as many days or less. On two occasions I have known two eggs to be laid in the same nest in one day. The usual number of eggs is five, but the number varies from three to six. The male does his half of the incubation, apparently with great cheerfulness, for he may often be heard calling out gaily to his mate as he covers the eggs, facing the breeze that rocks both him and his house up and down and to and fro.

As soon as the young are hatched they are fed on fragments of insects and spiders, among which I note a variety of small wild bees, and grasshoppers. I have never known snails to be fed to the young, though I know they are often devoured by the old birds.

In bringing food to the young ones the old bird invariably uses all the precaution possible, never flying straight to the nest, but first to some remote part of the tree, and, approaching the nest slowly and by watchful stages, at last feeds the young, an operation of a few seconds, and then proceeds to brood them till the return of its mate. This occurs in ten or fifteen minutes, the approach being always in the same cautious manner. The bird that is brooding keeps a sharp look-out, and, peering from side to side, sees its mate returning at a distance; and scarcely has this laden bird reached the tree before the other has left the nest and flown in a most direct and business-like manner for more food. It is evidently a very serious business bringing up a nestful of young ones.

The alertness of the brooding bird is almost incredible. A slight movement of my foot at 50 yards distance was at once detected, and was sufficient to cause the bird to silently leave the nest. I could scarcely credit this at first, and thought it must be a mere coincidence; but no, on repeating the experiment the same thing occurred twice more in succession. At another nest the same thing occurred. The female seemed more alert in this respect than the male.

The young are expert at voiding the ordure over the edge of the nest, and the nest may sometimes be discovered by the ordure on the ground beneath. This leads me to suspect that the building over water may be for secresy, the ordure being dropped into the water.

The young fly in about a month, and thenceforth look out more for themselves.

In an emergency it appears the parents will attempt to teach the art of flying to quite young birds. A nest containing a pair of young birds unable to fly, but one of which could flutter, was placed on the ground. The parents tried to entice the young out of the nest by their cries and motions. The male in particular would stand on a limb near the ground and wave his wings in imitation of flying, and the conclusion was irresistible that he was showing the young what he wanted them to do, namely, to make an effort to fly. Every flutter of the young was encouraged by special cries of the old birds, as much as to say, "That's it!" "Keep on!" "That's right!"

The Pee-wee lives to verify the saying that there are no birds in last year's nests. A nest is never used but once, though a second nest is not infrequently built alongside the first. On several occasions I have seen no less than four nests, on boughs varying from 1 to 6 inches in diameter, in the same tree, all in various stages of decay; and as I have never seen more than one occupied nest in a tree at a time the conclusion is fair that nests are built in succession in favourable trees, perhaps by the same pair of birds.

Passing along the banks of a river in a locality frequented by these birds, I have often come upon these favourite trees, as they may fairly be called, but though I have often tried to fathom the reason for the birds' choice I have never succeeded. Truly, such trees were generally of large size, but why these particular ones and not others equally large, and to me, at least, as attractive, I do not know, and yet I have no doubt there is some very good reason. I have tried to convince myself that the particular trees chosen were safer from the attacks of crows, hawks, and climbing animals, but with only indifferent success. To be sure, a number of cases seem to support this hypothesis, as, for instance, when I found a number of these favourite trees placed alongside and very near the railway. The contrast between the quiet and unconcern of the mother Pee-wee brooding her young, and the

rushing, thundering, shrieking, hideous din of the train a few yards away was laughable and very suggestive. Have we not here a bird that would, if not hunted, take up its abode in our very midst, putting up with our noisiness for the sake of the protection afforded from its natural enemies? It is reasonable to suppose, and, as far as I have observed, actually the case, that nest-robbers, such as birds of prey and climbing animals, are fewer near railways, and may not this account for the location of these particular favourite nesting trees? Where birds are left unmolested, or, rather, where useful birds are left unmolested, some of their number soon frequent the trees near houses and near gardens. The Pee-wee is one of these, and it is disposed to confide in us, relying on our protection. If we only had the sense to appreciate the situation, we might encourage a valuable ally.

One of the four-footed marauders gets caught. (Native or marsupial cat, *Dasyurus viverrinus.*)

The course followed by the eggs and young of these birds is a perilous one. Sharp-sighted robbers circle in the air above by day, and four-footed marauders scramble up from below both by day and by night, and between these, what with hawks, crows, iguanas, and cats, it is no wonder if many a fine brood comes to grief. One season I had nearly half a hundred nests under casual observation, and can testify to a considerable loss from the attacks of these thieves. I suspect that on more than one occasion my tracks were followed up the tree from below. Claw marks on the smooth limbs told a suspicious tale. Where iguanas are numerous, eggs in open nests are not what the life insurance companies would call a safe risk.

An easy way, not well known, to head off these climbing thieves has occurred to me. Nail a broad band of sheet metal round the trunk of the tree. After trying various captive animals, I find that none of the ordinary kinds can pass such a band if it is 12 inches wide, so here is a new use for the ubiquitous kerosene tin. Split the tins open and nail them round the trunks of fruit trees a foot or more above the ground, and the fruit is safe from opossums and all other climbers. The same protection could be extended to the nests of useful birds such as the pee-wee, and this, in fact, is why I mention this simple, effective, and inexpensive device. Many a tree could be so protected at a very trifling expense, amounting to no more than the cost of a dozen nails, and the trouble of driving them.

Tree with sheet-metal nailed round the trunk to ward off noxious climbing animals, such as fruit-eaters and nest-robbers.

In order that the reader may have a fuller account of our native snail-eating birds I insert here two extracts from Gray's "Birds of Australia," one on the mud lark and the other on the white-fronted heron.

GRALLINA AUSTRALIS (G. R. Gray). "Pied Grallina."

Gracula picata, Lath. Ind. Orn. Supp., p. 29.
Pied Grakle, Lath. Gen. Syn. Supp., vol ii., p. 130—*Ib.* Gen. Hist., vol. iii., p. 169.
Tanypus Australis, Oppel.
Grallina melanoleuca, Vieill. Anal. d'une Nouv. Orn., pp. 42 and 68.—*Ib.* Ency. Méth. Orn., Part II., p. 693.—Vig. and Horsf. in Linn. Trans., vol. xv., p. 233.
Grallina bicolor, Vig. and Horsf. in Linn. Trans., vol. xv., p. 233.
Grallina Australis, G. R. Gray, List of Gen. of Birds, 2nd Edit., p. 33.
Grallina picata, Strickl. in Mag. Nat. Hist., vol. ii., p. 335.
Corvus cyanoleucos, Lath. Gen. Hist., vol. iii, p. 49?
Magpie Lark, Colonists of N.S.W.
Little Magpie, Colonists of Swan River.

Bi̋j-yoo-gőol-yee-de, Aborigines of the lowland, and Dii̋-a-but, Aborigines of the mountain districts of Western Australia.

"Future research will, in all probability, establish the fact of this bird being universally dispersed over the greater portion of Australia. I have specimens in my collection from New South Wales, Swan River, and Port Essington, all of which are so closely alike that no character of sufficient importance to establish a second species can be detected. Those that came under my observation in New South Wales were never seen very near the coast, but frequented the rich alluvial flats, and sides of the creeks and rivulets of the interior.

"Few of the Australian birds are more attractive than the present, or more elegant and graceful in its actions, and these, combined with its tame and familiar disposition, must ever obtain for it the friendship and protection of the settlers, whose verandahs and housetops it constantly visits, running along the latter like the pied wagtail of our own island; in fact, the two birds, except in size, are very similar. Mr. Gilbert states that in Western Australia he observed it congregated in large families on the banks and muddy flats of the lakes around Perth, while in the interior he only met with it in pairs, or at most in small groups in not more than four or five together; he further observes that at Port Essington, in the north coast, it would seem to be only an occasional visitant, for on his arrival there in July it was tolerably abundant around the lakes and swamps, but from the setting in of the rainy season in November to his leaving that part of the country in the following March, not an individual was to be seen. It is evident, therefore, that the bird removes from one locality to another, according to the season, and the more or less abundance of its peculiar food. I believe it feeds solely on insects of various kinds, particularly aquatic grubs, grasshoppers, and coleoptera generally.

"The flight of the *Grallina* is very peculiar, and, unlike that of any other Australian bird that has come under my notice, it much resembles that of the common pewit of Europe, and is performed with the same heavy flapping motion of the wings; still the flight of the two birds differs materially during their passage through the air, the *Grallina* passing noiselessly and generally in a straight line, while the pewit makes sudden turns and dips—a peculiarity in its mode of flight, which must have been noticed by all who have seen the bird on the wing.

"Its natural note is a peculiarly shrill whining whistle often repeated.

"The nest may be regarded as one of the anomalies of Australia, so unlike is it to anything usually met with; it is from 5 to 6 inches in breadth, and

8 inches in depth, and is formed of mud, which, soon becoming hard and solid upon exposure to the atmosphere, has precisely the appearance of a massive clay-coloured earthenware vessel. As if to attract notice, this singular structure is generally placed on some bare horizontal branch, often on the one most exposed to view, sometimes overhanging water, and at others in the open forest. The colour of the nest varies with that of the material of which it is formed. Sometimes the clay or mud is sufficiently tenacious to be used without any other material, but in those situations where no mud or clay is to be obtained, it is constructed of black or brown mould; the bird appearing to be aware that the substance will not hold together for want of the adhesive quality of the clay, mixes with it a great quantity of dried grass, stalks, &c., and thus forms a firm and hard exterior, the inside of which is slightly lined with dried grasses and a few feathers. The eggs differ considerably in colour and in shape, some being extremely lengthened, while others bear a relative proportion. The ground colour of some is a beautiful pearl white, of others, a slight tinge of buff; their markings again differ considerably in form and in their disposition, being in some instances wholly confined to the larger end, in others distributed over the whole of the surface, but always inclined to form a zone at the larger end. In some, these markings are of a deep chestnut red, in others, light red with large clouded spots of grey appearing as if beneath the surface of the shell. The eggs are generally four, but sometimes only two in number; their medium length is 1 inch and three lines, and their breadth nine lines. It breeds in October and November.

"Although the sexes are very similar in size, the female may at all times be distinguished from the male by her white forehead and throat, a fact I determined many times by actual dissection, thus showing the fallacy of the opinion entertained by some naturalists of their being two distinct species.

"The male has a line over the eye, a patch on each side of the neck, a longitudinal stripe on the wing, tips of the secondaries, rump, upper tail-coverts, the basal two-thirds, and the tips of the tail, under surface of the shoulder, breast, flanks, abdomen, and under tail-coverts, white; the remainder of the plumage black, with a deep bluish tinge on the head, throat, chest, and back, and a green tinge in the primaries and tail; bill, yellowish white; irides, straw yellow; feet, black.

"The female differs in having the forehead, lores, and chin white. The young in leaving the nest have the irides black; in other respects they resemble their parents; but are, of course, far less brilliant in colour."

ARDEÆ NOVÆ-HOLLANDIÆ (*Lath.*), "White-fronted Heron."

Ardea--Novæ-Hollandiæ, Lath., Ind. Orn., vol. ii, p. 701.—Steph. Cont. of Shaw's Gen. Zool., vol. xi, p. 561.
White-fronted Heron, Lath., Gen. Syn., Supp., vol. ii, p. 304—Phill. Bot. Bay, pl. in p. 163.—Penn. Outlin., vol. iv, p. 128.—Lath. Gen. Hist., vol. ix, p. 127.
Ardea Leucops, Wagl. Syst. Av.; Ardea, sp. 17.
Herodias—Novæ-Hollandiæ, List of Birds in Brit. Mus., Mus. Coll., part iii, p. 80.
Wy-an—Aborigines of the lowland districts of Western Australia.
Blue Crane of the Colonists.

"The white-fronted heron is abundantly dispersed over every part of Van Diemen's Land, the Colonies of New South Wales, South Australia, and Swan River; but I have never seen it from the north coast, and consequently infer that it is not found there. Low sandy beaches washed by the open ocean, arms of the sea, and the sides of rivers and lagoons, both in the interior of the country, as well as near the coast, are equally tenanted by it, consequently it is one of the commonest species in all the countries above

mentioned; and may frequently be seen wading knee-deep in the water of the salt marshes in search of food, which consists of crabs, fish, and marine insects. Its flight is heavy and flapping, like that of the other herons, but it runs more quickly over the ground, and his continually moving about when searching for food, and never stands motionless in the water as the true herons do. These active habits are in fact necessary to enable it to capture insects and crabs, upon which it mainly subsists.

Looking for snails.

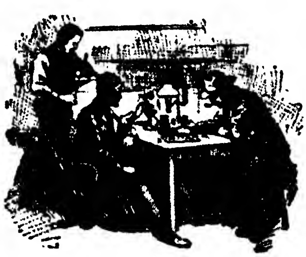
"Some nests I observed in the month of October, 1838, on the banks of the Derwent, were placed on the tops of the smaller gum-trees, and most of them contained newly-hatched eggs. Mr. Kermode informed me that it unusually breeds in the neighbourhood of his estate, which is near the centre of Van Diemen's Land. The nest is of moderate size, and composed of sticks and leaves. The eggs are four in number, of a pale bluish-green, $1\frac{7}{8}$ inch long by $1\frac{1}{4}$ inch broad.

"The white colouring of the face and throat is much more extensive in some individual than in others; and the base of the bill, the orbits, and irides are deep-lead colour in some specimens, while in others those parts are pale grey, and the irides pale buff.

"The stomach is very capacious, and the weight of the adult bird about 1 lb. 4 oz.

"Little or no difference is observable in the sexes, but the female is somewhat smaller than her mate.

"Face and throat white; crown of the head and back of neck dark slate colour; sides of the neck, all the upper surface and wings, dark grey, tinged with brown on the wings; primaries and tail-feathers dark slate colour; elongated feathers of the back grey, tinged with brown; elongated feathers of the breast cinnamon-brown; under surface grey, washed with rufous, which tint becomes gradually paler as it proceeds along the abdomen to the under tail coverts; down the lower part of the neck a strip of buff, gradually blending above with the white of the throat, and below with the cinnamon tint of the breast; irides in some lead colour, in others yellow, and in others pale buff; orbits and base of the bill, in some pale grey, in others deep-lead colour; base of the lower mandible of a flesh-colour."



(*To be continued.*)

Explanatory Note on the List of Fertilisers published in the May Gazette.

F. B. GUTHRIE.

This list, as has been already stated, is compiled in the interests of the farmers, its main purpose being to afford intending purchasers of manures reliable information as to where the particular products they require may be best obtained, and to enable them to compare the different fertilisers with each other, both as to price and chemical composition.

The revision of this list will be an annual undertaking, and it is hoped in future to have it ready for publication earlier in the year.

Such a list is necessarily full of imperfections, and it is with the object of discussing its shortcomings with readers of the *Gazette* that the following remarks are made.

Purchase of Manures.

The efficacy of a manure depends upon its chemical composition, the nature and amount of fertilising ingredients; to a less extent upon its mechanical condition, degree of fineness.

Every reputable dealer will furnish a guarantee by analysis of the nature of his product.

On no account purchase a manure without such guarantee. In the case of bone-dust, for example, the amount of nitrogen and phosphoric acid should be stated, or their equivalents in ammonia and phosphate of lime respectively. In the case of mixed fertilisers the nitrogen may be either organic (as in blood or bone-meal), ammoniacal, or nitrate-nitrogen according to the nature of the ingredients used. In the same way the phosphoric acid has different degrees of solubility, as is explained in the list. In addition, the mixed fertilisers may contain potash salts, the percentage of which should also be stated.

It is of importance that products like dried blood, bone-dusts, offal, &c., should be in a fairly fine state of division, coarse bone-dust being very slow in its action. The soluble fertilisers with superphosphate as basis are nearly always either finely powdered or easily broken up. Moreover, these products are readily dissolved, and the fineness of division is not of so much importance.

It is entirely your own fault if you purchase worthless fertilisers, or if you are misled by high-sounding names. The simple rules are to know what you want, to deal only with reliable people, to insist on a guarantee as to chemical composition, and, if necessary, to send a sample of your own choosing before purchase for analysis.

The Department will analyse it gratis, and tell you whether you are getting value for your money.

Sampling Manures for Analysis.

The objection may be raised that the figures given in the list, being the result of the analysis of small samples, do not in every case represent the composition of the bulk of the manure offered for sale.

Even if this were the case, the publication of the results would be justifiable, as they are readily checked and refer generally to samples submitted by purchasers from the bulk of their purchase.

As a matter of fact, every precaution is taken to ensure that the samples whose analyses are published shall be representative ones.

In the case of those sold in Sydney, there is no doubt that the samples are representative. I have always found the agents willing to afford every facility in the matter of proper sampling, and in many cases an additional sample is obtained without their knowledge.

In the case of manures manufactured and sold in other parts of the Colony, such strict check is of course impracticable, and in cases where no sample of the product has been submitted by a farmer, the results published certainly refer to samples chosen by the seller. There is, however, not the faintest reason to suppose that these have been improperly selected.

In any case, if a purchaser has cause to suspect that the dealer has succeeded in getting an analysis made of a sample which does not represent the stuff he sells, he has simply to forward a sample to the Department, when such unscrupulous dealing can be promptly exposed. Indeed this is a duty he owes to his fellow farmers.

Even in cases where no dishonesty is suspected I would recommend this course being adopted, as the composition of the most carefully-prepared manures is apt to vary. This applies more especially to flesh and bone products.

Valuation of Manures.

The question of assigning a definite money value to the different ingredients is also one open to some objections. In England many of the best authorities refuse to assign a fixed value, and simply state whether or not, in their opinion, the manure is worth the money asked.

In the United States they go to the other extreme, and as the sale of manures is under State control, the manufacturers have to accept the standards fixed by the experiment-station chemists.

The objections to the American system are several, and undoubtedly bear somewhat hardly in some cases upon the manufacturers. The question of the cost of grinding and mixing and bagging is one that is quite outside the province of the chemist, and the fertilising values of the different ingredients (especially the nitrogenous ones) are by no means the same as the selling values. Moreover, the comparative fertilising values are still in many cases not yet settled.

I shall show that in our case these objections do not apply, and our values simply afford the means of comparing two similar products.

A glance at the list shows that we can class all the locally-produced fertilisers under one or two distinct heads.

1. Flesh and bone products, including dried blood, bone-dust, dried offal, mixtures of blood, flesh, and bones ground together.
2. Simple salts, such as sulphate of potash, containing potash only, and sulphate of ammonia, containing nitrogen.
3. Mixed fertilisers, the basis of which is superphosphate, to which sulphate of ammonia and potash salts are added.

The products of the first class are untreated, except by drying and grinding. These may all be fairly compared with one another, both in cost of production and the manurial value of their constituents.

The nitrogen in dried blood, crushed bones, and dried meat has, as far as we know, very much the same fertilising value.

It would have been more complete to assign different unit-values to the ingredients in coarse and fine products, and at first such a distinction was attempted. It appeared, however, to be hardly worth the trouble, as the products on the market are nearly all well ground; the coarse ones are so designated in the table, and moreover that is a matter that the purchaser can judge of for himself.

When we get products containing organic nitrogen in other and less assimilable forms, such as untreated leather-waste, horn-clippings, &c., it will be time enough to raise the question of a different unit-value for them.

Again, the phosphoric acid in such of these products as contain it is, as far as we know, in the same state of combination with the lime, and consequently of the same manurial value.

When we come to fixing the manurial value of the nitrogen in ammonium salts we have no option but to accept the value assigned to it by the Australian Gaslight Company and the Colonial Sugar Refining Company, who are the only manufacturers.

As the fertilising value of nitrogen in this form is considerably higher than that of the nitrogen in the meat products, it is no hardship that it should have a higher money value.

The matter is still simpler in the case of potash. For the potash-salts in the market there is one source, and one only, namely, the salt deposits at Stassfurth. All the kainit and sulphate and chloride of potash we obtain comes from these mines, consequently the price at which they are retailed here must be the basis of our standard.

As has been said, the principal objection to such a valuation lies in the difficulty of appraising the cost of mixing, bagging, &c, of mixed fertilisers.

In our case the Sugar Company are the only manufacturers of these compounds on any considerable scale. They all have as a basis the spent bone-char from the sugar refinery treated with acid and mixed with sulphate of ammonia and potash-salts.

As long as the manufacture is carried on by only one firm, their own valuation is obviously the only possible one.

It is, furthermore, a perfectly reasonable one, and it will be seen that our valuation, based on the separate items, agrees quite closely in all cases with the price asked.

I think I have said enough to show that our valuation is not based on arbitrary unit-values, but follows the actual prices ruling in the market, and affords a ready and fair means of comparing the value of the different substances.

It must, of course, not be forgotten that the market values alter from time to time in accordance with the requirements of the market, and it is, therefore, necessary to revise them periodically. The alterations are not likely to be of any extent before the next revision of the list, and whatever they are they will affect similar products in the same way; they will never make a poor bone-dust of the same value as a rich one.

Mixing Manures.

Whether it is best to get complete fertilisers ready mixed, to obtain a formula and get a manure-agent to do the mixing, or to purchase the ingredients separately and mix them yourself, is a question that depends very much upon the individual.

A farmer using manures on a large scale, especially if he knows little about the principles of manuring, will undoubtedly find it preferable in every way to adopt one of the first two courses.

If, however, the quantities employed are small enough to be readily manipulated, and if the farmer is conversant with the principles and the requirements of his crop and his land, he will probably find it more satisfactory and instructive to mix his manures himself.

Not only because he thereby saves the cost of mixing and avoids paying for an excessive quantity of an ingredient which he does not require, but also because so doing makes him think, brings home to him the connection between plant and soil and manure, and opens his eyes to the peculiarities of his surroundings. If he finds the treatment adopted does not answer his expectations he can more readily vary it.

In this way he learns to experiment, and progress becomes possible.

Seeing, however, that unsuccessful experiments in manuring are likely to prove somewhat costly, I would strongly recommend consulting the Department, in ordinary cases, as to the best formulas to serve as a basis.

All that is necessary is to forward a statement as to the crop which is to be grown and a description of the nature of the soil, including analysis, if possible, together with any other information bearing upon the subject.

Separated Milk as a Food for Calves.

M. A. O'CALLAGHAN.

The importance of this subject is readily demonstrated by the fact that, if not at present, in about three or four years' time every cow then milking in the Colony will have been reared mainly on separated milk, and if we are to have healthy cows of good constitution, capable of yielding a large supply of rich milk, it is evident that they must receive suitable treatment in their babyhood. See what the Jersey cow has come to; look at its high position in the bovine family, and then consider that this eminence is largely due to care and kindness while young, and you will realise what can be done. If *farmers will not raise healthy, vigorous calves, bred from good parents, they cannot have dairy cows that will pay*, and with such a state of things we must couple the, at least, partial abandoning of dairying, the consequent inutility of our dairy factories, the ruin of our butter-merchants and all dependent on them, as well as the loss of numerous allied industries. Thus it is seen that to a very material extent the dairy industry and the entire dairy revenue of the country depend on the treatment doled out to the young stock.

Pure new milk is the natural, and hence the best, food for the calf, but as butter-fat is a very valuable substance we remove it from the milk, thereby rendering the residue—viz., skim-milk—an unnatural, and hence, an insufficient, food for calves. If we look at the analyses of whole and skim milk we shall at once see that the separator leaves behind all the valuable constituents save the fat.

Whole milk averages about 13 per cent. of solids and 87 per cent. of water. The total solids are made up as follows:—Fat, 3·80 per cent.; casein, 2·80 per cent.; albumen, 0·70 per cent.; ash, 0·75 per cent.; and milk-sugar, 4·95 per cent.

Skim milk contains about 9·65 per cent. of total solids, viz., 0·20 fat, 2·75 casein, 0·75 albumen, 0·80 ash and 5·15 milk sugar.

We now see that if we add something of a suitable nature, and containing a high percentage of oil or fat, we restore to the milk its original feeding value. The trouble is to find a substance rich in fat which is agreeable to the health of the calf, and, at the same time, sufficiently cheap for disposal in this manner to be profitable. Experience has taught us that crushed linseed makes a very suitable substitute for the butter-fat that has been removed, and we do not know that we can buy a cheaper food so well adapted for the purpose required. Linseed contains about 35 per cent. of oil, and is of about the same digestible value as milk. There are a couple of methods of adding the linseed—one being to boil it in water, and then mix about equal parts of the mucilage and the skim milk. Some people adopt a simpler course, and add the ground linseed to the warm milk direct, stirring it till they get well mixed. Personally, I prefer the

former method. About 8 quarts of milk and from a quarter to a half pound of linseed a day (according to age) is sufficient food for a calf. As the calf grows older a little crushed oats might be substituted for the linseed. In fact, it is hard to get a better food for young stock or for dairy cows than ground oats, and it might be here remarked that the butter made from cows fed with oats is hard to excel. The Danes use large quantities of oats for feeding their dairy stock. When mixed with bran and supplemented by good hay or ensilage it makes a very useful and valuable food for milch cattle, and as it can be grown on most farms, it should have the preference over purchased foods.

To return to the separated milk, we must now point out that it cannot be treated and used just anyhow, and that numerous sins can be committed through it. The milk should be fed to the calves at about blood heat, 98° F., or, at any rate, not less than 85° F. This will in most cases necessitate the warming of the milk after it has been received from the factory; and now the question arises, will this milk stand warming about 5 p.m., having been received from the factory the morning of the same day? Herein lies the crux of this calf-feeding question. If the milk is properly treated at the farm-house before despatching to the factory, and if it is afterwards properly treated by the creamery or factory, it should be capable of being fed to the calves that evening at a temperature of 98° F. without coagulating. But if the farmer takes little or no care of the whole milk, but allows it to stand in cans imperfectly cleaned, does not strain it carefully immediately it is milked, never thinks of aerating it, and often keeps it over night in surroundings not burthened with a pure atmosphere, he cannot expect the creamery to return him a very perfect skim milk, nor perhaps does the creamery take the trouble to do so. Before the farmer can expect the creamery to be perfect he must endeavour to do something himself, but immediately that he has put his own house in order he should make it his duty to see that the creamery-owners do likewise, at least as far as the separated milk is concerned.

When milk gets sour the sugar of milk becomes changed into lactic acid, through the action of micro-organisms, and much of this acid is injurious to young calves, with the result that when acid milk is largely fed many calves die, and those that do not die are weak and miserable-looking. I might here state that the organisms which cause this souring are not introduced into milk through the cow, but gravitate into it after it is milked, with little bits of dust, hair, &c., that fall from the cow's coat or from the atmosphere. Then, again, some creameries unfortunately take little care of the vessels in which the separated milk is kept; these tanks are generally made of wood, and are placed on a platform, sometimes 40 or 50 yards away from the dairy, the milk being pumped there through a pipe which, to say the least of it, is in many of the creameries I have seen absolutely forgotten. Nobody ever seems to think it wants cleaning, with the result that it becomes coated on the inside with slimy matter of a decomposing nature and of an offensive odour. To this is added the fact that the milk-tank into which this pipe empties is also very often neglected. Sometimes it is nobody's business in particular to clean it (at least so I have been told), and sometimes it is the business of some boy, who takes the residue of the milk and washings. This boy does not appear to be under direct control of the creamery manager, and he seems to trouble himself very little about cleanliness. I have seen tanks that have been evidently left uncleaned for months, but it is not easy to get a look into them, and I have had to use my gymnasium training as a means of getting up to them. When I got my head over them I felt

very much inclined to use my jumping powers to get quickly away from the tank. There are not many instances so bad as this, but I have seen more than a couple. Nothing in dairying, has ever surprised me as much as the general carelessness with which this department is treated. It seems to have been the intention of the farmers who put up the creameries to neglect these milk-vats, and allow them to smell unpleasantly, else why did they place them so far away from the creamery proper. There is no reason why they should not be a part and parcel of the dairies, as they are in other countries, and instead of many yards of piping have only a few feet of it, which should be unscrewed and scalded with steam daily. The milk passing through those foul pipes, even into clean tanks, is not fit for calf-food, for besides causing the milk to decompose rapidly and deteriorate in feeding value, there is every likelihood of the development of chemical ferments known as enzymes, which frequently produce substances of a highly poisonous nature. The directors of those creameries really occupy a responsible position, and it is high time that they became alive to the dangers which a want of proper supervision might bring about.

Even apart from any of these causes milk rapidly sours in a warm climate, and if it is heated up to 90° or 100° F. for separating, and the separated milk not cooled rapidly afterwards, it will be sour before the calves are fed with it that evening, and this brings us direct to the necessity for scalding or Pasteurising, for in this only can a safe remedy be found for checking the development of acidity, and in dealing with the effects of Pasteurising we come to the prevention of infectious diseases such as tuberculosis, a subject that is of extreme importance to New South Wales, as it is to every other country.

Pasteurising.

This sounds a word of very little meaning to dairy farmers, and people seem to think it is a subject of much mystery. This is not so—it simply means the heating of milk to a temperature that will render lifeless the bacteria or organisms that are vegetating therein. This temperature is found to be about 167 degrees F. The system is so named after the celebrated French scientist Pasteur. The organisms that produce lactic acid are killed before this temperature is reached, and hence, if the surroundings of the milk are kept clean, such milk will not quickly sour, and can be fed quite sweet to the calves many hours after it is separated. The milk should, however, be rapidly cooled after it is heated, for we must not forget that though we might have killed all these acid-producing organisms the atmosphere of the dairy and of its surroundings is full of them, and they quickly gravitate into the milk, also that they possess the power of reproducing under favourable conditions by means of spores; but as they can produce only very slowly at low temperatures, we reduce the temperature of the milk, and thereby prevent the new ones which get into the milk from the atmosphere, dust, &c., from multiplying rapidly, and so keep the milk sweet for a considerable time.

Now the disease called tuberculosis is also produced by a species of micro-organism, and you will see that, as in the previous case, if we destroy those that are in the milk by means of heat, we need have no fear of infecting the calves. I might here mention that the milk of cows, wherein the disease of tuberculosis has reached the udder, has invariably been found to contain the organism that brings about this disease, and that in cases of experiments animals fed on such milk, unless it has been diluted, have always been found to be infected.

Professor Bang has demonstrated the fact that it is possible to rear healthy calves from infected cows, simply by separating the healthy from the diseased animals, and by boiling the milk of the tuberculous cows; hence the importance of scalding or Pasteurising the milk. Koch's tuberculin test is looked upon by most scientists as a reliable means of detecting this disease, and the Danish Government gave £3,000 a year for five years to assist farmers desirous of using the tuberculin test. By this means can be discovered the animals that are infected before the disease goes to the udder, and hence they can be isolated or destroyed.

It has been demonstrated that if even very virulent tuberculous milk be exposed to a temperature of 185 degrees F. for a few minutes, it can be used with impunity. The importance of pure milk for human use will be understood when we hear such an authority as the Medical Officer for Health for Glasgow state that a seventh part of the death-rate was due to tuberculosis.

In cases where factories wish to Pasteurise the whole milk before separating, it is not feasible or wise to heat the milk to 185 degrees F.; hence it is always better to heat the milk after separating to one temperature (say 185 degrees F.) and the cream to another (say 155 degrees F.) If, however, milk be kept at a heat of 155 degrees F. for about twenty minutes, the germ of tuberculosis is killed, as well as most others, as this has been found to be one of the germs most capable of resisting heat.

All this goes to show that where separated milk is used as a calf-food it is very necessary that all vessels with which it comes in contact should be kept in a clean condition, and also that if the milk be Pasteurised it can be used in a better condition for food, besides doing away to a great extent with the danger of the spread of tuberculosis from this source.

Influence of Bees on Crops,

(Continued from page 425.)

ALBERT GALE.

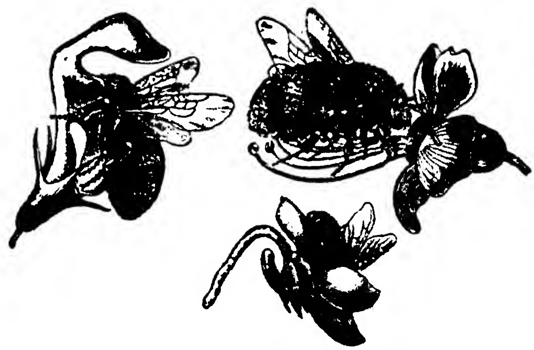
There is nothing more interesting in the life-history of the vegetable kingdom than the methods and agencies of its reproduction. Fascinating as it is, it is too often the stumbling-block of amateurs whose love of plant-life carries them to look into the deeply-hidden mysteries of this absorbing subject. The sexuality known to exist in blossoms; their matrimonial instincts; their marriage ceremonies; their domestic ties; their methods of raising and perpetuating their families and co-relations; the officiating and conjugating priests, and the agreement between the contracting parties, are all more or less like fairy tales than actual facts.

These matrimonial ceremonies, how they marry and are given in marriage, is the portion of the subject I here wish to deal with. The arrangements of the sexual reproductive organs and their various functions have already been dealt with.

In the higher members of the plant-world there is a very great difference between pollen cell and the ovule (little egg) that are joined to form new individuals. The former of these is smaller than the latter, and more active; it is the male; and the latter, of course, is larger than the former; is composed of richer matter, and is passive—it is the female. From the nature of these ovules, these passive eggs, they cannot become seed or plants until they are united with and fertilised by an active or live pollen grain. The essential organs in blossoms known as anthers contain these active cells, the cells of life. The pistillate organs contain the passive cells, the cells of matter. The pistil in apples, pears, or other fruit blossoms is the bride, the stamens seen in blooms of like trees are the bridegrooms, and the honey-bee is the licensed officiating priest who is to perform the connubial ceremony. Let us for a while watch these officials of nature carry out some of their highly-important duties. Bearing in mind, whilst so watching, the table of kindred and affinity wherein it is stated a man may not marry his grandmother or a woman her grandfather, &c., and note how these insects, without a written law, are never parties to close or blood relations intermarrying; neither does their natural instinct permit them to perform unnatural alliances. They will not attempt to marry an orange to an apple, or a pea with a pumpkin, or a pear with a cherry, and so on; neither does nature permit them to marry the male of a blossom with a female of the same bloom. Such alliances in the higher plants are repugnant to all concerned. Nature's motto in the vegetable kingdom, as well as in the animal, is, especially when aided by the intelligent hand of man, "upward and onward." If the pollen of a blossom were transmitted to the carpels of the same, the result would be degradation, and the loss of some of the choicest varieties of fruit and vegetables we now raise from seed.

The ovary is composed of one or more carpels. The ovary of an apple bloom has five such carpels. In the mature fruit these are termed the core.

In the early spring mornings, when the bees issue forth to go in quest of stores, the first thing they gather is pollen. It is the first product the blossom yields, even before it secretes its nectar (honey). In their eagerness to be first on the foraging ground, they leave home at about sunrise. If they have selected an orange to gather their stores from, they will keep upon orange or some other member of the citrus tribe during the whole of that peregrination. Tumbling about in the cup of the flower amongst the anthers, they gather up in their fur numberless grains of these life cells, pollen grains. Head, thorax, abdomen are all more or less dusted with it. Whilst gathering it, and whilst on the wing from flower to flower, and tree to tree, they are busily engaged in packing it in the pollen baskets that are situated in the upper part of the hinder legs. As the day warms, the blossoms unfurl; the central whorls develop, and the stigma becomes receptive. The bee, eager in her duties to supply her home with abundance of food, both for the young brood and winter storage, commences her search for honey. In the early morning there is little or no nectar secreted; but as the warmth increases so the flow of honey advances. Anxious to fill her honey-sac whilst gathering the pollen she enters the blossoms where she will find the greatest abundance of her favourite winter storage, and thrusts her tongue down into the nectries of the blooms. To get at the honey more readily she lies on the top of the essential organs, and brushes to and fro on the stigma. Whilst thus engaged, the fur on the various parts of her body retain pollen grain;



Bees in the act of fertilisation.

those on her breast come in contact with the stigmas of the flowers. Having commenced working on an orange for pollen she will not go to an apple or aught else for her honey. Citrus fruits supplied the pollen, citrus fruits must provide the honey. Why? Because nature has endowed the bee with that intelligence—there is no other word so applicable—to know if she were to take the pollen of an orange to the stigma of an apple, as far as fructification was concerned, her labour would be useless. Pollen from one species of the vegetable kingdom can seldom be used successfully, even by artificial means, to fertilise that of another species. When it is successful the result is a hybrid, the descendants of which cannot be perpetuated by seed, but only by cuttings, graftings, &c. Bearing in mind the characteristics of the stigma, its adhesiveness, and its hairy hooklets, the bee's breast, coming in contact with the latter, it acts as a comb or brush, and aids in detaching the pollen grains from the fur of the bee. These grains fall on the adhesive stigma, and are retained by its vicidity. When this contact takes place—sometimes at once, at other times it may be delayed for hours—the cell of life starts into activity by throwing out a pollen tube, which at once

goes in search of the cell of matter contained in the passive ovule. To accomplish this the pollen-tube makes its way down the style which connects the stigma to the ovary. The silky threads that protrude from a cob of corn, delicate as they are, are not too fine or too long for these active tubes to penetrate. The style of the orange, &c., is also as easily pierced. The ovule, or young seed in the ovary, contains the embryo of the future plant. The pollen-tube having found its way to the ovule, the union of the respective cells takes place. The ovule thus receiving the "germ of life," the infantile development of the future orange or other tree, as the case may be, commences.

When the contact of the two cells has been accomplished, the calyx withers; the corolla, with the dead remains of the stamens adhering thereto, falls to the ground; and the pistil in most cases is absorbed in the fruit.

These developments will be better understood by reference to a peach or other stone-fruit. When the ovule has thus been fertilised, the seed, or, as it is generally termed, the kernel, is the first to develop, followed by that of the hard shell surrounding it, the stone; and at the same time the flesh increases and matures with the gradual expansion of the outer skin. We then say it is ripe, *i.e.*, its flesh has become useful as food to man, and the seed capable of reproducing its species.

Now, it must be obvious to the most casual reader of these articles that the bee has played the imperative part in the production of these fruits. Nothing else could have accomplished it so effectively and with such beneficial results as the little busy bee. Other insects live on honey and pollen, but no other insect is endowed with the instincts of social bees. They work so systematically in cross pollenisation. They make no mistakes. They will carry pollen from variety to variety, and sometimes from species to species, but not from order to order. After a foraging excursion they are never seen to return to the hive with different varieties of pollen on their bodies. In examining a cell of pollen in the hive, each stratum is seen to belong to distinct species of the vegetable kingdom (not varieties). With other insects that only feed on pollen grains, they consume it on the anther whereon they alight. It is for immediate consumption for each one's present wants. Where other insects visit one blossom bees will visit a hundred. Watch a butterfly on a flower and compare its actions with the rapid movements of a bee, and judge for yourself which is the better worker of the two. You must bear in mind that in early spring, flowers, and especially fruit blossoms, mature rapidly. Of the essential organs the anthers in most cases come to perfection first, and are the first to die. The pollen is distributed in a very few hours, and its vitality in most instances is short-lived. The pistil with stigma and its carpels are very delicate organisms, therefore liable to all kinds of accidents. When we remember the chief characteristics of the stigma, it will be seen that a dust storm is capable of clogging it, and thus prevent fructification. A dust storm in early spring has a deal to answer for in the failure of fruit crops, so has heavy rain, wind, or anything else that may bruise those very delicate portions of the flower. From this will be seen the imperative necessity for some rapidly-moving agent to convey the perishable pollen to the highly-sensitive stigma. The numerical strength of these agents must be in proportion to the quantity of work they have to do, or the areas under fruit culture they are expected to visit. If bee-keepers and their bees were banished from Australia there would be fruit, but in what quantities? I have referred elsewhere to the mischief done by butterflies and some other insects, but no such mischief ever follows in the wake of the bee. Fertili-

sation by agents other than bees would be sufficient to perpetuate species of fruits, and occasionally to produce varieties, but to fertilise heavy crops sufficient to feed mankind they are too inactive, and the mature insects numerically too weak. If adult butterflies, &c., were equal in number to adult bees a famine would follow in the track of their larvæ as disastrous as that caused by the armies of locusts that have been known to sweep over the Holy Land in times past. Numerous insectivorous birds and other animals almost live exclusively on insects, their eggs and larvæ, and thus their injurious ravages are somewhat checked.

How wonderfully has nature protected this invaluable insect—valuable not as a honey-storer, but as a fruit-producer. Practically the adult bee has no enemy, if we except the wood swallow, and in the egg and larval stages its home is almost impregnable to invaders. Of course, like the human family and other animals, it is liable to the "ills that flesh is heir to." In a state of nature bee ova and larva have one arch enemy—the bee moth—and it is as well it should be so. Bees in a state of nature are a great drawback to beekeepers. The honey, when obtained, is of a fourth-rate quality owing the quantity of foreign matter mixed through it. That same honey if stored in the frames of the hives of practical beekeepers, would be worth four times as much as when obtained as bush-honey. But this is a digression. To the careful beekeeper, enemies, not diseases, to the eggs, larva, and young bees are rarely known. The beekeeper having his stock under control can, with the greatest ease, regulate the supply and demand.

No district can be overstocked with bees, if we regard them as fruit-fertilisers only, but as honey-gathers it is another matter. The greater number of bees kept in an orchard or fruit district the more rapidly is fertilisation carried on. Once the bee has carried the pollen to the pistil, the act of fructification being successful, the development of the fruit is assured—the fruit has *set*. A few days after the bloom of the trees has disappeared the infant fruit can be seen in the early stages of growth. Standing near an apple, orange, or other tree when the fruit is in its earliest stage, and a gentle wind shakes the branches, you will sometimes hear the fruit falling in hundreds, or if the tree is shaken the same results will follow. In walking through an orchard in spring-time young fruit just formed are always seen in greater or less numbers scattered on the ground. The premature falling of these fruits is the result of imperfect fertilisation, caused either by slight injuries to the stigma or an insufficient number of bees to discharge the duties nature requires of them, *i.e.*, fructification.

(*To be continued.*)

Poultry Foods.

(Continued from page 341.)

J. J. McCUE.
(Poultry Expert, Hawkesbury Agricultural College.)

I HAVE often noticed chickens that required three months within which to attain weights that should be reached in ten weeks, as it is well known that a system of high feeding will force a chick 2 lb. in ten weeks, yet the majority of the chicks reared do not reach that weight until they are nearly three months old.

The food eaten during those extra weeks is usually more than that which would be eaten by the chick in ten weeks, as the waste of bodily heat goes on during the prolonged time. Hence it is economical to feed the growing chicks all they will eat; and the better their appetites, and the larger the quantity consumed, the more rapid the growth, and the earlier they reach the market. There is no saving in trying to make a small quantity of food go as far as possible. Feed liberally, and thereby secure the largest gain in the shortest time.

If there is any one article of food more misused than any other in feeding poultry it is *corn*. Its over-use produces a deposit of fat in all available parts of the body, which in time is likely to be followed by fatty-degeneration of muscles and organs.

It is conceded by the majority of poultry-breeders that the breakfast or morning feed should consist of soft food, because the digestive organs contain the least amount of food in the morning, and it is desirable to feed soft food at this time, when it will be digested and assimilated quicker than whole grain.

My rules for feeding are these:—As soon after daylight as possible I have my boiling water ready; then I get my pollard mixed with a little bran, and if any meat-scraps, or soup are left in boiler I mix with the dry pollard and bran, adding a little salt, then mix the lot with boiling water into a stiff, crumbly mass, not soft or sloppy. The breakfast is fed warm, and the fowls get as much as they will eat with an eager appetite, and no more. The penned fowls get a small dinner occasionally of grain or meat-scraps; the grain is placed under the litter, and the fowls are compelled to scratch for it. Fowls that have a good run do not need a midday meal, their supper of grain being sufficient. I also feed green-cut bone occasionally; fowls are very fond of this, and will eat it ravenously every day.

Feeding for Eggs.

In feeding for egg-production a valuable lesson may be learned from nature. Many of our domestic fowls that receive little care and attention, or, in other words, whose conditions approach more nearly the natural conditions, lay most of their eggs in the spring. It is our duty, then, as feeders to note the conditions surrounding these fowls at that time. The weather is warm, they have an abundance of green food, more or less grain, many insects, and plenty of exercise and fresh air.

Then, if we are to feed for egg-production, we will try to make it spring-time all the year round; not only in providing a warm place for the fowls, but also giving them good food, a proper proportion of greenstuff, grain, meat, pure air, exercise, and clean, pure water.

Hens cannot produce eggs unless their food contains the elements of which the egg is composed. The kind of food that is offered to them must be determined by the object to be attained in feeding them. Hens intended for market should be fed with that kind of grain which is known to contain a large percentage of fatty matter, and a fair share of albuminous substances; but hens kept as layers should be fed on a food which contains egg-producing elements. In addition to the essential quality of albumen required in the organism of the fowls, the laying hen requires an extra amount for ovation—the white of the hen's egg being about 12 per cent. of albumen—and this must be furnished in her food.

By referring to a chemical analysis of the different cereals it will be seen that corn contains the greatest amount of fatty substances, while wheat contains a larger amount of albumen than any other cereal. To fatten hens, therefore, feed with corn; to procure eggs, give a liberal supply (all the fowls will eat up clean) of pollard, meat-scraps, &c., mixed, as shown above, for breakfast; at midday, a little oats or barley; wheat at night—and in wet or cold weather corn may be used to advantage—fed twice a week. Meat twice or three times a week in winter months; cut green bones occasionally; and last, but not least, clean water, plenty of grit—crushed shells if possible; if no shells are handy, any other sharp grit will do, provided a little old lime-mortar is mixed with it; but if the hen-houses are well limed the mortar will not be required, as the hens will pick up all they require for shell-formation, for the whitewash scales and drops from the walls after it has been on a little time.

(*To be continued.*)

Winter Dressing against Black Spot.

M. BLUNNO, Viticultural Expert.

WE remind vignerons that the winter dressing of the vines against that fungoid disease commonly called "Black Spot" should be repeated every year a fortnight before the buds burst. All varieties, more or less intensively, are subject to it, and the disease thrives better in those districts where, during spring or summer, rains are not altogether scarce, and in any vineyard planted on low land, where, consequently, the air is moister.

The winter germs of the disease are hidden in the stem, and in the last year canes on which are mostly visible those black ulcers that afford them harbour, and inside of which the germs are protected by several beds of cells. Even at a comparatively low temperature, if the moisture is sufficient, they can develop and originate those spores which spread the disease on the new shoots and on the blossoms and grapes.

The time, therefore, to act with the winter dressing is when the winter germs, having lacerated the beds of cells to let the spores start, offer no protection against the dressing.

The old formula is: —

1 gallon warm water.
5 lb. sulphate of iron.
½ pint sulphuric acid.

It is now recognised that the effect of this solution is mostly due to the sulphuric acid, and very little or nothing to the sulphate of iron; therefore a simpler and cheaper formula is suggested, which has proved to be just as, if not more, effective.

This is a water solution of sulphuric acid of 6 per cent. in volume, which dose corresponds to a little higher proportion of the said acid than in the first receipt.

Practically, this second solution can be prepared with—

1 gallon of water.
¾ of a pint of pure sulphuric acid.

In the preparation of both the solutions care should be taken to pour the acid in the water little by little, or else the acid will spurt.

If the old bark is rubbed off previously the dressing will be more effective, and will also destroy many germs of other fungus or insect diseases. Neither of the solutions will do any harm to the buds if applied when they are closed and well protected.

The dressing may be applied with a swab or as a whitewash. All the canes cut off at the time of pruning should be collected and put away or burnt; if any of them are left on the soil, the winter germs may develop and burst off into spores even on canes severed from the stem, and be the cause of the spreading of the disease all the same, in spite of any winter dressing

that we may have used. The application of both solutions delays the budding of the eyes a few days, which is an advantage in vineyards subject to late frosts.

I saw last year vines attacked by the "Black Spot" while blossoming, or a few days after the set of the flowers, the clusters being totally blazed. The above remedies are both preventive, and are successful and sure if applied, as I have said, a fortnight before the spring of the eyes; if applied later, these would be injured; if earlier, the case may be that the solutions will not affect the winter germs, finding them still well protected.

Curative remedies are little reliable. They will form, however, the subject of a note for a next issue of this *Gazette.*

Orchard Notes for August.

GEO. WATERS,
Orchard Manager, Hawkesbury Agricultural College.

In the warmer parts of the Colony this month will bring with it signs of the approach of spring. Before the end of the month all pruning and winter spraying must be finished, as the buds will soon be bursting, and as the stronger solutions of spraying mixtures can be applied before this occurs, no time should be lost in completing this work.

Stone-fruit trees can be planted yet, and where citrus-trees were not planted during the autumn the latter end of this month is a very good time to do so, care being taken to select a mild and if possible cloudy day. Do not plant the last mentioned, or, in fact, any tree, when a strong wind is blowing, for even with the greatest care they are exposed for a certain time during the operation, and no trees are benefited by it. In the case of stone-fruit-trees, let me again impress upon all planters the necessity of cutting back about knee-high at planting. With citrus-trees, *before entirely filling in the hole*, give them a watering if the ground should be *too* dry, though after our favourable winter this will not be in many places. Never allow them to get a check. These remarks apply to all other evergreen fruit-trees as well, such as loquats, guavas, and olives. Where the fruit has been gathered from citrus-trees, and they are affected by any fungus or scale pests, this is a good time to do any spraying, before they make their spring growth, but do not spray while any blossoms are on. For Maori, or orange rust mite, and I am sorry to say the former is increasing very rapidly, it is best to spray two or three times with the summer solution of Bordeaux mixture; but if the first crop has not all been marketed; it would be spoilt for market purposes by the Bordeaux. Dusting the trees with sulphur by means of the sulphur-bellows or knapsack sulphurer in the early morning would help to keep down the orange rust. If the kerosene emulsion is intended to be used, be very careful that the mixture is properly emulsified.

In districts where the vine caterpillars were prevalent last year, I would advise using every endeavour to prevent their appearance this year. There is no doubt that "an ounce of prevention is worth a pound of cure." During the winter months these remain in the form of pupæ, which are found at the base of the vine, or in the crevices in the vine-stakes. They are oval in shape, somewhat sharpened at one end, and of a brownish colour. Keep a good look-out for them. Every one that can be found should be destroyed, and so save a lot of trouble afterwards.

Another bad pest that should be prevented from making its reappearance in an orchard is the peach aphis. It is not only confined to peaches, but it also attacks nectarines, apricots, and Japan plums. The ravages of this insect have almost disheartened stone-fruit-growers in some districts. If allowed to go unchecked it will rapidly spoil any tree it attacks. It exists

in a semi-dormant state during the winter, and may be found on the underside of small branches, on suckers or young shoots at the base of the tree, and also under the ground on surface-roots near the trunk. All trees that were attacked last year should be minutely examined, and all the insects destroyed; those on the branches by the resin-soda wash, or a weak solution of the kerosene emulsion. Under the ground they are not reached so easily; but if the surface soil, just round the trunk, is drawn away great numbers are killed by directing the spray well round the base. Forking in lime or gas-lime would cause them to leave the roots and ascend the tree, and the majority of these would be caught by means of a bandage tied round the tree and smeared with some glutinous substance, such as a non-drying oil boiled until it becomes sticky, molasses, &c. Towards the end of the month grafting can be proceeded with on old trees, or before on younger ones. Where grafts are put up high, see that they are well tied and painted with some grafting-wax to prevent the air getting to them.

This month is a good one for planting out shelter or ornamental trees. The shelter question is overlooked too much. Some of the best for this purpose are the Pinus insignis, Pinus pinea, Camphor Laurel, Tristania conferta, Grevillea or silky oak. All of these, except Pinus pinea, are quick growers, and make admirable ornamental shelter belts. When planting, if enough land is available, it is advisable to plant in double rows, as that makes a more complete shelter.

Practical Vegetable and Flower Growing.

W. S. CAMPBELL.

Directions for the Month of August.

In the warm districts of the Colony spring may be said to begin about August, and those kinds of vegetables which are tender, and liable to be injured by frosts, may be planted out, or seed may be sown.

This is a good time to get rid of many kinds of weeds, for the seeds will germinate now, and then is the opportunity to destroy them by either digging quite under the soil, or else by horse implements, if the garden is sufficiently large, or by hand-hoe. One of the very best of hand-hoes is that lately exhibited at the Brisbane International Exhibition, invented and patented by Mr. G. H. Grapes, of New Zealand. The writer was appointed judge of garden implements, and therefore had a good opportunity of thoroughly testing this hoe. It is a Dutch hoe, with a sharp, thin, steel blade, set at an angle of 45 degrees to the handle. The work that can be performed by this implement is surprising.

Probably some of the readers of these directions will start at this time of the year the work of vegetable-growing. It is wonderful how comparatively few persons engaged in farming grow their own vegetables, fruit, or flowers, but prefer to allow the Chinamen to supply and grow rich instead. The time that need be occupied in producing a large enough supply for a family is but trifling compared with the benefits likely to accrue. There need be no waste, for the pigs can be made use of to dispose of any surplus with profit, and all old vegetables, cabbage-stumps, &c., &c., should never be allowed to remain to occupy space which might be used instead for something far better.

In preparing land for vegetables the first operation to be performed is draining, unless it be naturally so well drained that all surplus water passes quickly away. It is, as a rule, safe to drain, no matter how well the land may seem to be naturally drained.

After draining, trench, or plough and subsoil plough, without bringing to the surface the subsoil. Make the surface of your ground as fine and level as you can before sowing or planting.

During the month the following vegetables may be sown or planted:—

Asparagus.—As the shoots or "buds" will soon begin to start into growth, this vegetable had better be planted as early in the month as possible. If you have not raised your own stock of asparagus for planting, you may be sure that you will find numbers of the roots of the plants you obtain injured by being crushed or broken. Cut off all broken roots with a sharp knife. Plant with care, and make a little mound for the centres of the plant

to stand on, so that the ends of the roots are lower than the centres of the plants. Cover the soil in carefully about the roots, and cover the crowns with soil to the depth of about 2 inches. The plants should stand about from 2½ to 3 feet apart, or even at a greater distance.

Artichoke, Jerusalem.—This very useful and nutritious vegetable may be planted in the early part of the month, or later still in the coolest districts in the Colony. Plant the tubers in trenches made about 6 inches deep and 3 feet apart. Drop the tubers a foot apart in the trenches, and cover up. The soil to be made rich with manure, and be well drained before planting. The roots will be ready for gathering when the stems wither away in winter.

Beans, French or Kidney.—Seed may be sown in any places where late frosts are not likely to occur. The ground should be well dug, drained, and manured. The best kind of manure to add to stable manure would be superphosphate of lime or bone-meal. Lime or lime rubbish applied to the soil after the stable manure has been dug in will be found advantageous. Gypsum is also very useful. Potash is another useful substance that might be added to stable or farmyard manure. Sow the seed in rows about 2 ft. 6 in. to 3 feet apart. Drop the seed in the drills about from 4 to 8 inches apart and about 3 inches deep in the drills. When the seeds come up, work the soil amongst them with the hoe, and destroy all weeds.

Beet, Red.—If you should have a portion of land from which a crop of cabbage has just been taken, and which had been manured rather heavily, it will be just the spot for young red beet. It needs fairly rich soil, but not that which has been but recently manured. Sow the seed in drills 18 inches apart and about 1 inch deep in the drills. Cover with fine soil, and firm down the soil. Thin out by degress the plants when they are 3 or 4 inches in height to about 9 inches to 1 foot apart.

Beet Silver.—This is made use of for its leaves and not the roots. Manure the ground well, and sow the seed in drills 18 inches apart, and thin out the plants to about 18 inches apart.

Broccoli, Brussels Sprouts, Cabbage, Cauliflower, Savoy.—Sow seed of these vegetables in seed-beds thinly in drills about 2 inches apart. If plants are available, plant out from 2 to 4 feet apart according to variety and richness of the soil, the greater distance being necessary if the soil is rich. Manure heavily.

Celery.—Sow a little seed in a seed-bed or box, and when the seedlings have grown to the height of about 2 inches, plant out in a well-prepared bed about 2 or 3 inches apart. Here they will soon increase in size, and will make fine strong plants for planting out in trenches later on.

Cardoon.—Plant out in rich soil 3 feet apart each way, if plants are available. The portion of cardoon used in cooking is the leaf-stalks of heart leaves. Sometime before use, the leaves are tied up together, and this causes the inner leaves to become white and tender.

Celeriac or Turnip-wold Celery.—This is similar to the ordinary celery in flavour, but instead of the usual leaf-stalks a sort of turnip takes this place, and is used. Plant on the flat, and not like the usual method of planting in trenches. The soil should be made very rich.

Carrot.—Seed may be sown to any extent during the month, in rows about 1 foot apart.

Cucumber.—Seed may be sown with some protection from frosts.

Leek.—Sow a little seed in a seed-bed, and afterwards transplant seedlings to very rich ground.

Lettuce.—Sow a little seed in a seed-bed. Plant any young lettuces that may be ready and large enough. Make the ground rich, and do not let the plants become over-dry during their growth.

Melons, Cucumbers, Marrows, &c.—Sow seed in districts where frosts are over. Previous to doing so, drain and dig well, and manure thoroughly with rotten farmyard manure.

Onions.—Sow a good quantity of seed after the onion beds have been well made and well manured. The surface soil should be made level and quite fine. Sow the seed in drills 12 to 15 inches apart. Do not bury the seed deep. Keep the young plants quite free from weeds.

Parsnip.—Sow largely in drills, and follow the directions given for red beet.

Peas may be sown largely in drills 3 feet to 3 feet 6 inches apart.

Potato.—Plant a few rows of early kidney variety. The ground should be well drained. Plant in rows about 3 feet apart, and drop the potatoes about 1 foot apart, and 5 to 6 inches deep.

Radish.—Sow a little seed in rows.

Rhubarb.—Plant in rich, well-drained, and deeply-dug soil. If roots can be obtained, plant about 4 feet apart, sufficiently deep that when planted the crowns be covered with about 2 inches of light soil.

Salsify or Vegetable Oyster.—Seed may be sown in light rich soil, in rows about 15 inches apart. Thin the seedlings to about 4 or 5 inches apart.

Turnip.—Sow a little seed in rows about 1 foot to 15 inches apart.

Tomato.—Sow a little seed in a situation whence the young plants can be protected from late plants. Tomatoes may be planted out in the vegetable garden if any plants are ready, but they should be protected from frosts.

Flowers.

During this month flowers of many kinds should be forthcoming in abundance. Many kinds of bulbs, such as daffodils, jonquils, anemones, tulips, ranunculuses, freesias, and others should be in bloom. Bulbs are most interesting and desirable plants to grow, and throughout the year it is possible to have some kinds in bloom.

About this time of year many different kinds of irises may be planted. The Japanese varieties are very beautiful and easy to grow. They require moisture at the root and a bright sun to come to perfection.

Tender annuals and perennials may be sown in the garden, or, if some have been raised under protection, they may be planted out.

Some of the best kinds to grow are—*Acrocliniums*, album and roseum; amaranths or cockscombs; the globe amaranth, *Gomphrena celosia cristata* or true cockscomb; and the ornamental-leaved amaranths; *Antirrhium*, or snapdragon, of various kinds; *Aqulegia*, or columbine, ters balsams; *Bartonia aurea; Browalia alata; Coreopsis campanula*, or Canter bury bell; candytuft of different colours; carnations, especially the Marguerite varieties; cornflowers of various colours; Marguerite chrysanthemums; Clarkia; cosmos; dahlias, single; datura; larkspur; dianthus

of various kinds; foxgloves; eschscholtzra, gaillardia grandiflora, and other varieties; helichrysum; sunflowers of varieties; hollyhocks of varieties; honesty; ipomopsis elegans; sweet peas; linum coruneum; lobelias; lupins; maurandia, alba and rosea; creepers; mignonette; forget-me-not; dwarf nasturtium; nemophila; pansy, of varieties; petunia, double and single; phlox Drummondii of varieties; picotees; portulaca rhodanthi; salpiglossis; salvia; saponaria; scabiosa; stocks; marigolds, or tagetes; Virginian stocks; and zinnias.

The best time for planting evergreens is during the autumn, and the next best time is during the early spring; therefore, take the opportunity before it is too late to plant out any evergreen that may have been forgotten, such as bouvardias or camellias.

Prune roses of all sorts, except Banksian, no matter if they have started to grow. Cut away all dead and hard growth, and prune hard without fear, especially the weak-growing varieties. After pruning, clean the stems from any scale or parasitic growth; burn prunings, destroy all weeds, hoe or fork very lightly, and spread a dressing of farmyard manure.

General Notes.

Inferior Ingredients for Spraying Mixtures.

From time to time complaints are made about the unsatisfactory results following the use of insecticide and fungicide sprays, and many growers have reported that their trees have been seriously injured, and in some cases killed, by sprays mixed and applied strictly in accordance with the Department's advice. When hundreds of fruit-growers testify to the beneficial effects of spraying the same mixtures, suspicion naturally falls upon the quality of the ingredients. Some months ago the Chemist of the Department, Mr. F. B. Guthrie, analysed some brands of Paris green, and the results of his examination were published in the *Gazette*, Vol. VII, Part 11, page 754. Recently the Manager of the Wagga Wagga Experiment Farm forwarded two samples of bluestone, which had been submitted to him by a local firm, who stated that No. 1 was a sample of the quality which they specially imported, and No. 2 a sample of some recently obtained from a Sydney agent. The specimens were brought under the notice of Mr. Guthrie, who analysed them, with the following results:—

No. 1 (small dark blue crystal), pure sulphate of copper, containing about 96 per cent. crystallised copper sulphate.

No. 2 (large light blue-coloured crystals) contained—

87 per cent. ferrous sulphate (crystallised).
12½ per cent. copper sulphate (crystallised).

This shows that No. 2 is quite unsuitable for spraying purposes where copper sulphate (bluestone) is required, and accounts for much of the want of success achieved by Bordeaux mixture spray. The Minister for Agriculture, in view of the importance of protecting fruit-growers against imposition in this way, desires it to be intimated that the Department will undertake the analysis of any samples of substances purchased for spraying purposes, about the quality of which there may be any doubt.

Prickly-pear as a Fodder.

Mr. W. L. Boyce, of Warraba, Lochinvar, sends the following account of his experiment with prickly-pear ensilage. It might be mentioned that a sample of this product was brought under the notice of the Agricultural and Dairy Conferences, and was favourably commented upon:—

"In my article in *Gazette* of April last, under the above heading, I mentioned that I had included twenty loads of prickly-pears in a stack of ensilage with maize and sorghum. I now have the pleasure of forwarding you a sample, and reporting unqualified success. The cattle like the pears quite as well as the other constituents of the ensilage, and prefer these pears to the steamed pears, which I am still giving them.

"The ensilage was made in a stack in the open, and pressed with home-made mechanical appliances and covered with iron. Owing to the drought the stack is only a small one, which makes my present triumph the greater. The base of the stack is 19 ft. x 16 ft. 6 in., and only 3 feet high in its compressed state. I estimate that the pears amount to one-third of the whole stack. In building the stack I put alternate layers of pears and maize or sorghum, four loads of pears in one layer, but never allowed the pears to be nearer than a foot to the edge.

"At present I am feeding the cows on this ensilage, steamed pears, and barley, all on the same day; there is also a good picking of green herbage, yet everything is eaten up clean. The milk test is at present 4 per cent. of butter fat, which is amongst the highest at my creamery.

"Now, as this ration has a good proportion of prickly-pear, the facts stated prove that there is considerable virtue in the much despised prickly-pear.

"It only remains for me to add that the pears were placed in the stack whole, including thorns and roots, the largest bunches being afterwards chopped to flatten them.

"The heat and ferment of the silo has softened the thorns and rendered them harmless.

"I always add a bag or more of coarse salt to a stack to make the fodder more palatable."

Ornamental Trees for Agricultural Societies' Show-grounds.

The Minister for Agriculture recently decided to distribute from the State Forest Nursery young trees for the improvement of Agricultural Societies Show-grounds, and, recognising how easily pests may be inadvertently introduced to clean districts by means of nursery stock, Mr. Smith instructed the Entomologist, Mr. W. W. Froggatt, to examine the trees intended for distribution. As the result of careful investigation, Mr. Froggatt reports:—

"I went over the young plants in the bush-houses and propagating-grounds and found everything wonderfully clean. I have never seen less scale in any nursery. In the grounds the only scale in any quantity is the 'brown scale' (*Lecanium olea*), and there is not a garden in Sydney where this cosmopolitan coccid is not more or less in evidence. It is worthy of note that it has covered the olive-trees—its native food-plant in France, whence this scale originally came. A few other scales (*Aspidiotus nerii* and *Dactylopius Albizziæ*) were observed, but both upon Australian plants. I consider that there is no danger of trees from the Gosford State Nursery spreading any destructive pests."

The Effects of Sorghum.

Mr. George H. Commins, of Springfield, Wagga Wagga, writes:—"The question of cattle being poisoned by sorghum is a very important one, and I desire to add my testimony. If cows are turned into or fed on sorghum before it comes into tassel they get 'blown' and die. It should never be given to cattle until it is turning to seed."

Grazing on Wet Lucerne.

Mr. Commins also writes:—"Cows should never be allowed on lucerne when it is wet, either from dew or rain, or they get 'blown' and die in the same way."

Seed-sowing.

It is a common complaint among amateur gardeners that the seed they purchased at one time or another failed to germinate, and the seedsman is generally blamed. Sufficient consideration is not, however, given by the sower to the question of special conditions necessary for the germination of seeds, governed by the original habitat of the plant, whether tropical, semi-tropical, or severely cold.

The tropical seed will require a temperature of not less than 80 degrees, with considerable moisture, while the semi-tropical may do with 60 degrees of heat, and the hardier plants vary in their proclivities till some may germinate at a temperature a little above freezing-point. If artifical means are adopted to force seeds on, then at this time of the year, in the absence of a glass-house and heating apparatus, a hot-bed and frame will be the best for the purpose. What is termed a cold frame may be brought into use later, when frosts are over and the warmth of spring is gradually expanding into the stronger heat of early summer.

Seeds that are known to take a long while to germinate should be sown as soon as ripe, or in early autumn, and they will probably burst forth in the spring-time sooner or later; while if they were sown in spring they might lie in the ground till the following season sets in; in the meantime if weather too dry or too wet sets in, the seed may perish from one or the other cause.

For most purposes connected with a small garden seed-sowing in shallow boxes is preferred. If the soil is moderately damp a very fine spray over the surface of the soil will be sufficient in the matter of watering in the first instance. A few days later, if the soil appears to become too dry, and especially if the seed is of a very fine description, it is best to immerse the box in water in such a manner that the moisture will be taken from below, with no disturbance of the surface soil. The boxes after being sown are best put in a moderately shady place, and as soon as the seeds germinate bring the seed-box into a position where the plants will get a fair amount of air and light, and yet will not be scorched by sun or perished with strong drying winds.—H. V. Jackson, State Forest Nursery.

Curing Date-plums.

P. F. Adams, Casula, Liverpool, has been good enough to forward the following note on curing Date-plums:—

The term curing suits the process better than drying, as it more resembles tobacco-curing than fruit-drying in the ordinary sense.

The fruit easiest prepared is the yellow variety, having a pointed end and turning red in ripening.

As all the fruit must be peeled, it is desirable only to grow that which can be readily dealt with.

The fruit may be ripened either on the tree or off. I prefer the latter, having the necessary appliances.

I learned the process from Japanese servants, who nearly all appear to understand it; and certainly the fruit cured by them was the best, but the process was too elaborate for profit.

The trays of my evaporator suited the occasion, by strewing clean straw on them, and laying out the fruit. The trays were set out in the sun for a few hours every fine day.

On the small scale the fruits can be hung on a wire stretched along a verandah in a situation where the sun will reach them for three or four hours a day. No other attention is required. In four or five weeks they undergo a complete change, losing their original flavour, and assuming that of the date, only far more delicate.

Hanging by the stalk improves the appearance ; each fruit shrinks into a regular form, whilst those cured on the trays are contorted and do not look inviting.

The date-plum is very slightly affected by handling, and may be pinched many times in testing for ripeness without injury ; in this it differs from most fruits.

When ready for curing, the outside offers about the same resistance to the knife as a hard apple ; at the same time the inside is beginning to soften. This can be ascertained by pinching the fruit.

The longer the curing from first to last the better the result. A change takes places, either chemical or organic, in which sugar is elaborated to a great extent. Any attempt to hasten the process by artificial heat checks it, and the result is failure.

When the sugar is seen to exude and crystallise outside, care must be taken to prevent exposure to damp, or the sugar will absorb moisture, and decompose. As soon as the sugar is well out, upon the surface, and the fruit feels consistent throughout, not soft and pulpy inside, the curing is complete, and it is advisable to pack in tins on a dry day and put away for keeping.

The Japanese bore a hole through the stalk of each fruit, through which they pass a string with a needle, then the fruits are strung together without touching, upon a mat, made out of straw envelopes (bottle) cut open and flattened. These are tacked to a board, and the whole put out in a sunny spot every day or two, and repeatedly turned.

Some Spraying Results.

Mr. Thomas Wrench, of Mulgoa, writes:—I have spent a great deal of time in spraying the different washes and mixtures on my trees and vines, and if I have not always been successful, it is no fault of mine, or the *Gazette* remedies ; other things have militated against my efforts, over which I have had no control. Some two seasons have passed since about the end of September, I sprayed some Muscat grape-vines (just after bursting, and when about 4 inches' growth had taken place) with Bordeaux mixture, made by the directions given in the *Gazette*. It killed every shoot. I had often sprayed the same grapes, before and since, with mixture the same strength, and no injurious effects resulted therefrom. I attribute the injury in this instance to a very cold night following the spraying, and a very hot day succeeding the cold night. Undoubtedly the weather had a deal to do with the injury done, as other vines alongside and not sprayed had only the edges of their leaves singed. I have kept the "Black Spot" well in check, principally by winter dressings.

Codling Moth.—I have been very successful with the bandages. I take a chaff bag, and cut strips about 6 or 8 inches wide, and long enough to go round the tree and tie in one knot. Fold it two or three times, so as to make it nice and comfortable for the grubs to hide in ; then go every ten days and kill them. The bandage will do to put on again. But my neighbours have been growing these pests, and sending me a fresh supply on the wing without my order. If every orchardist resorted to the bandaging process, and attended to it, the codling moth would soon be a thing of the past.

Woolly Aphis has been the most trouble to me. I have fought it both above and under the ground. I have laid the roots bare, and cut and cleaned away all roots, large and small, that I could find affected with it, and used blue oil emulsion, 1 in 10, on the bare roots, which kills the aphis instantly, and, so far, it has not done any injury to the trees. Generally, I have found the insects near the surface. I find it very expensive to treat them underground. The hot, dry weather we had has kept them in check this last season.

The remedy for Pear-leaf Blight (*ammonia-carbonate of copper*) I have never succeeded in using to my satisfaction. I have often tried it, but without any good resulting. It appears to me that the remedy is most required when the trees are in full bloom; and, as all the washes are supposed to be injurious to the bloom, I tried another remedy—1 part of carbonate of copper to 6 parts of newly air-slacked lime, well mixed together, and put on with a sulphur-bellows, at a time when there is no wind. First spray some water all over the tree, and immediately blow the powder on with the bellows, and do it as often as required when in full bloom. I have applied this remedy the last two years to my pear-trees, and it has checked the fungi without injuring the bloom, and they are quite clean and free from blight.

Replies to Correspondents.

Treatment of Young Trees.

A LARGE number of correspondents have asked for information as to the handling and planting out of young fruit trees. Want of space prevented the earlier publication of the following notes, furnished by the Fruit Expert, Mr. W. J. Allen: "I cannot too strongly impress on the planter the importance of using the utmost precaution in getting only young, healthy trees—not necessarily large, as medium-sized trees are, in my opinion, best. In removing them, if they have to be sent by rail, have the roots puddled; then have the trees packed closely in a box with damp moss or straw; and finally cover over the trees with hessian, nailing same to the case to keep it in place. When planting, take two or three trees out at a time, dip the roots in water so as to loosen the soil on roots adhering after puddling, then carry the whole in a wet bag, and when hole is made ready to plant, take out only one tree at a time. Spread the roots well, and avoid planting them any deeper than they were in the nursery. Make some allowance for the loose earth settling after the tree is planted, and if ground is at all dry, give it one or two buckets of water, or just enough to settle the earth around the roots to exclude the air. Do not be afraid to cut the tops well back, as in removing the trees the roots have to be cut, therefore doing away with feeding power; consequently, if tops are not well cut back, the chances are that trees will wilt and die, or only continue to keep green without making any growth."

The use of Water in Orchards and Vineyards.

MR. S. B. MEDCALF, of Maroota, Sackville Reach; Mr. J. J. Klein, of Guilford; and many other correspondents, have asked for advice on this important matter. Mr. Klein desires to know whether it will pay to irrigate with water costing 6d. per 1,000 gallons.

The attention of our readers is specially directed to the information on the subject given by the Fruit Expert, Mr. W. J. Allen:—

"There appears to be some doubt in the minds of many orchardists as to how and when water should be applied to the different kinds of fruit-trees and vines. In planting, some have used water to settle the earth around the roots, and have at times lost trees, the water getting the blame. There are times, of course, in planting when it is not necessary or desirable to use much water, and, in fact, any deciduous trees planted whilst the ground is quite moist in June, July, or early part of August do not require any water, provided the roots have not been allowed to dry up in transit, or exposed for too long a time in the open air. It is well, therefore to get deciduous trees planted early, so that the roots will get a firm hold of the ground before the hot weather sets in.

"The planting of citrus trees without water is rather more risky, and whilst good results may follow at times without it when the earth is moist, it is always advisable to give the trees just enough to settle the earth around the roots and force the air out of the ground, and when the earth is dry enough loosen the top with a fork hoe, either before or after the orchard is cultivated. I take it for granted that the cultivator will be set to work as soon as the planting is done. If it be warm weather when the young citrus trees are planted, they should, three weeks from the day of planting, receive another light irrigation—say, from two to four buckets of water put into a circular trench which has been opened up around the young tree, and not closer than a foot to it. Always avoid letting the water come in contact with the butt of the tree, as this is one of the causes which produce collar-rot. After this second irrigation the trees should all start to grow if they have been properly planted; and the planter who handles citrus trees will do well to handle them most carefully, as there are more trees lost through the roots becoming exposed to the air and sun than by any other means.

"If only a limited supply of water is to be had, and this not laid on at the highest corner of the orchard, either by pipes or open drain, then you will do well to cart it; and the best means is to have either a tank mounted on wheels so that a horse can be hitched to it, or put an ordinary 200-gallon tank into a dray, attach a canvas hose to it, and with this it will be possible to water a good number of young trees in one day. The water can be applied at any time when necessary, whilst the trees are young, without damaging them. Where irrigation is extensively carried on, we usually avoid watering our trees, and more especially our vines, whilst they are blooming and setting. This, in a fairly moist climate, can always be avoided if the orchard and vineyard receive proper winter cultivation; but in an irrigation colony, where the planter has to take the water when the Irrigation Company see fit to supply it, or go without it for maybe six weeks to two months longer, he sometimes has to take it at the very time when it is not required, as possibly, if he decided to wait, his vines would be dried up and worthless; therefore, between two evils it is always best to choose the lesser, and take the water when the grapes are blooming or setting, as the case may be.

"From two to four waterings, according to climate, should be sufficient—citrus trees requiring most and vines the least.

"Where water has to be paid for at the rate of 6d. per 1,000 gallons, and is delivered on the highest point of the land, it should pay to irrigate if the planter has a rich soil to work upon; and should he not care to cart the water, and at the same time to use it economically, he might make a circular trench around all his trees, the distance of the trench from the tree depending on the size of the latter—as while it would have to be fairly close around a small tree it could be 4 feet away from a large tree. Then between every two rows of trees run a furrow with a one-horse plough right down the centre, for the purpose of running the water, and cut a small furrow from the centre one to the trenches around the trees, allowing the water to run to the tree until the trench is full, when the water should be shut off, and start it on to the next tree; and so on until finished. If the stream of water is large it could be run on to two trees at the same time. Continue taking two rows at a time in this way until the whole orchard is finished, after which it will be necessary to put the cultivator to work. Although this method will take more water than by carting it, it will not prove more expensive, as much more ground can be gone over in a day; but I would recommend in any dry climate, where there is a quantity of good soil and

water is available, getting an engine and pump—say, four-horse power, with 4-inch centrifugal pump, which would lift sufficient water to irrigate from 100 to 150 acres. This would make it possible to grow either **fruit, lucerne,** or **hay** during the driest seasons; and even during those seasons when there is a fair rainfall there are times when, if water were available just when it was required, the crops might be doubled. I will quote an instance of my own. In April, 1896, I sowed 9 acres of wheat and oats. Before ploughing I gave it a thorough irrigation. As soon as the ground was in a fit condition to be worked I ploughed and sowed the grain. On the 1st of August I gave it another watering, and a third about the middle of October. The crop was cut and carted in November, and cut into chaff in January. After feeding 1½ ton to horses, I paid for chaffing 26½ tons four bags, or 28 tons in all, thus making over 3 tons to the acre. This was grown on mallee land, with limestone subsoil; and within a couple of miles from the same paddock, on similar land, and where water was not available, the land did not yield a ton to the acre.

Thousands of Acres available for Irrigation.

"Scattered along the banks of the Murray, at intervals, there are thousands of acres of the very best soil going begging for someone with brains to develop them. If a half-dozen active young men were to put their capital together, go and choose 200 or 300 acres of rich red loam, not too heavily timbered, and from 30 to 50 feet above the level of the river, and buy an engine and pump, such as I have described, they could grow anything they wished in abundance—oranges, lemons, apricots, peaches, grapes, &c.—and it would only be a question of a few years before they would have very good returns. In this connection I might say that the reason why so many irrigation settlements have failed is because those who chose the land were not particular to choose such soil as was most suitable for fruit-growing."

Chestnut-growing.

In reply to several correspondents, who have asked for information about chestnuts, the Fruit Expert, Mr. Allen, says:—The chestnut seems to thrive fairly well in either the cooler or medium warm districts in Australia, and I should say would grow in stiff red-clay soil, provided same were sufficiently drained, as these trees will not stand their roots being in saturated ground for any length of time, and the land will require to be worked deeply, as the trees require freedom for their roots. In selecting the trees, choose those having a fair proportion of the latter, and with clean, straight stems, and plant from 30 to 35 feet apart, as in time these trees grow to a very large size, and require plenty room for development. But little attention in the way of pruning is required by the chestnut, except in the case of young trees, which must have their growth regulated so as to produce large and symmetrical trees as quickly as possible. If the trees should make too great a growth, and not bear, it would be well to root-prune during the winter, and before active growth has commenced.

Clean cultivation is also necessary for these trees, as any undergrowth of herbage during the early summer months is particularly injurious, and I would recommend stirring the soil lightly and frequently with a hoe rather than ploughing or digging to keep down the weeds.

Table to correct Specific gravity.

MR. J. S. ARMSTRONG, Yeola Valley, Robertson, asked for a reprint of a table to correct specific gravity, which he considered would be useful to himself and others engaged in testing milk by the "Babcock." The following is taken by Mr. F. B. Guthrie, Chemist to the Department, from Thorpe's "Dictionary of Applied Chemistry":—

VARIATION of Specific Gravity with Temperature.

0°	10°	20°	30°	0°	10°	20°	30°
1·857	1·846	1·835	1·825	1·402	1·394	1·386	1·379
1·807	1·796	1·784	1·773	1·352	1·344	1·336	1·330
1·754	1·745	1·735	1·726	1·300	1·293	1·287	1·280
1·704	1·695	1·685	1·676	1·250	1·243	1·237	1·230
1·654	1·645	1·635	1·626	1·200	1·193	1·186	1·180
1·604	1·595	1·585	1·576	1·149	1·143	1·137	1·131
1·552	1·544	1·536	1·528	1·098	1·093	1·087	1·082
1·502	1·494	1·486	1·478	1·048	1·043	1·037	1·032
1·452	1·444	1·436	1·429				

Weevils in Maize.

MR. EDWARD YOALE, of Ulmarra, Clarence River, asks:—"Why are weevils more prone to attack the early maize grown on rich land than on the poorer? On the Clarence River-bank farms the land is rich, and the weevil commences its ravages sooner on this land than a poorer soil at the back."

In reply, the Entomologist, Mr. Froggatt, says:—"Probably because the weevils are more plentiful along the river-banks. Most of the weevils that attack the maize in the field come from barns, and places where corn is stored or shipped and stacked. If the farmers were careful to destroy all rubbish, and keep their barns clean, the weevil pest would be much decreased, for it is the eggs deposited by the mature beetles that hatch into the grain-eating larvæ. Second-hand bags, in which weevilly maize has been put, are also a means of spreading the pest."

In reply to Mr. C. J. Deverell, Bellinger, who has also asked for information with respect to maize-weevils, Mr. Froggatt says:—"The weevils are bred in the stored corn, and, where the corn is growing in the neighbourhood, fly out and infest the cobs before they are harvested; thus apparently sound corn may be full of the eggs of the weevils before it is bagged. If the corn were kept in closed bins, as is done in many parts of America, and treated with bi-sulphide of carbon as soon as the weevils appear, they would soon be killed off.

One pound of bi-sulphide will kill all beetles in 100 bushels of corn, and it is applied by means of a piece of soaked cotton wool.

Locusts and Grasshoppers.

MR. R. H. MATHERS, of Parramatta, asked for the particulars of the life-history of locusts and grasshoppers.

Mr. W. W. Froggatt, Entomologist, is not sure whether the "plague locusts" that are so destructive to grass, crops, &c., or the cicadas, that are so musical in summer, are referred to. The eggs of the "plague locust"

are deposited in the ground in masses of several hundred, the female boring a circular hole in the soil and laying her eggs at the bottom. The tip of her abdomen is furnished with a set of small plates that enable her to cut into the hardest ground. The young locusts (larvæ) emerge next spring, and by a succession of moults as they increase in bulk, at the final moult emerge as fully-developed winged insects.

The grasshoppers differ from the "plague locusts" in having a long sabre-shaped ovipositor sometimes as long as the body, and though some lay their eggs in holes in the ground, others deposit them upon leaves, grass, &c. Grasshoppers attain maturity in the same manner as the locust.

The cicadas, which are so commonly called locusts, lay their eggs in slits they cut in the branches of the trees. The larvæ, as they hatch out, throw themselves to the ground, and make their way below the surface along the roots of the tree. They live underground for a considerable time—some species for years—before they crawl upwards, cast their pupal skins, and come out as the fully-developed winged cicada.

Small Brown Fly on Potatoes.

Mr. Thomas Waldron, of Junction Farm, Canley Vale, reported last season that the potato plants in his locality were attacked by a small black (or brown) fly on the ends of the leaves. The leaves turned brown in colour, and the ends drooped. On digging the potatoes they were found to be punctured in many places by small white grubs—in many places half-an-inch in depth—and with a deposit on the outside. The greater part of the crop was destroyed. The potatoes were just as much affected in virgin soil as in land cultivated for years.

Mr. Waldron added that he found it difficult to grow cabbages and turnips on account of the "aphis" and cabbage moth. He had tried coal-tar and kerosene, tar-water boiled, without success.

The Entomologist, Mr. W. W. Froggatt, is of opinion that the fly referred to is the "Rutherven Fly Pest," which is a small brown bug, and not a true fly. It has been plentiful in various parts of the Colony this year, and is a terrible nuisance. It lives in the rubbish under the plants, and is therefore hard to destroy with a spray. Lime and soot sprinkled or dusted over the potato plants would help to keep the fly off. The grub attacking the potatoes themselves was probably the larvæ of the potato moth (*Lita solanella*), and may have been introduced in the seed potatoes. All damaged or infested potatoes in such a case should be destroyed, and the sound ones carefully stored, so that the moth cannot lay her eggs upon them. For the cabbage moth, a good spray is 1 lb. of Paris green to 100 gallons of water.

Rust on Plums.

Mr. F. A. Brown, of Candelo, is troubled with rust on his plums. He says:—"Last season, when the fruit on two well-laden plum-trees were the size of marbles, the leaves and fruit became of a rusty colour, and began to fall off, ultimately leaving the trees bare. Others in the district complain of the same disease. In my case, it was not for the want of moisture, cultivation, or pruning."

Mr. Allen, Fruit Expert, states that the rust spoken of closely resembles peach rust, but is common also to the apricot, almond, and plum. It generally makes its appearance about midsummer or soon after; but as a

matter of course the time varies according to the climate and season. Sometimes, however, this pest appears much earlier in the season. The fungus first appears in the form of minute yellow spots, which expand in size until they run into each other and form blotches. The under sides of the leaves have corresponding dots and blotches, and from these the spores are distributed. These blotches finally assume a dark rusty-brown colour. When, as is very often the case, this fungus attacks the fruit, the latter assumes a blistered and scabby appearance. The rust fungus injures the trees by absorbing the sap from the leaves, causing them to fall prematurely, and consequently preventing the proper development of the young wood and fruit buds.

Preventives.—Burning all affected leaves. Sulphate of iron used as a spray, and watering the ground with a stronger solution; or it may be used in the powder, from (say) ½ lb. to each tree; or bluestone and ammonia.

The sulphate of iron is mixed as follows:—1 lb. of iron to 5 gallons of water. Apply in the evenings when the leaves are damp.

Bluestone and ammonia. Dissolve 2 lb. of bluestone in 1 gallon of warm water, then add 1½ pint of ammonia, and 20 gallons of water. Apply as a spray.

Non-productive Windsor Pears.

Mr. Edwin S. Rush, Port Hacking writes:—"I would like to know the reason why Windsor pear-trees become non-producing, and the cure (if any). They blossom every year, but no fruit sets."

Mr. W. J. Allen, Fruit Expert, reports:—"I would recommend a pruning while the tree is in bloom, and a dressing of manure rich in potash. If that has not the desired effect I would give the trees a root pruning, starting about 4 feet out from the tree, and circling about half way round it at the same radius for the first year, and finish the remaining half the following year. If the tree is on a pear stock, this should give good results; but often they are grafted on worthless stock, and in consequence only do well for a few years, after which they cease bearing.

The Persimmon.

In response to the request of several correspondents, the Fruit Expert, Mr. W. J. Allen, has furnished the following information concerning the persimmon:—

Although this fruit is grown in many gardens in Australia and California, it has not as yet attained to the popularity it deserves, probably owing to the fact that so little information as to its habits and uses has been available. However, it is fast finding its way into public favour; and as the demand increases so also will the supply, so that in the long run there will be those who, being unable to find ready markets for their surplus, will be pleased to know that the fruit when dried or preserved is almost equal to the fresh. The persimmon or date-plum, although peculiar to China and Japan, and attaining to greatest perfection in those countries, is yet found in different varieties in all semi-tropical climates. The Chinese or Japanese date-plum, the produce of *Diospyros kaki* embraces a number of varieties, the most famed of which are Ronosan, Nihon, Mikado, Daimio, Taikoon, Yamato—the latter particularly large and sugary, and being one of those mostly used for drying. As, however, this fruit has not been extensively grown in Australia, the experience as to the relative merits of the varieties

introduced is too limited to arrive at positive conclusions at the present time. The fruit should be kept for at least ten days after picking before being eaten, as if eaten direct from the tree it has a most insipid flavour, the richness and sweetness of the flavour seeming to depend upon chemical decomposition in the fruit.

Crichton says that the date-plum may be grown successfully in most parts of Australasia, but will probably give the largest returns in the medium warm districts.

It is a deciduous tree of somewhat slow growth, and does not attain a very large size, coming into bearing when four or five years' old. As the trees increase in age they bear more freely up to a certain limit, and as a rule are fairly prolific. The ground should be deeply worked, and when necessary drainage must be provided for, as the trees cannot thrive with an excess of water at their roots. Planting may be done at any time during the winter, but the most favourable time is July or up to the middle of August, according to the locality. The distance apart should be from 21 to 24 feet, and care must be taken not to plant too deeply. Young trees should have their growth regulated so as to obtain strong and well-formed specimens as soon as possible. Summer pruning may be practised with advantage with young trees; older trees must have their growth regulated according to their requirements; and as the fruit is chiefly produced on the young growth, the last season's shoots should be shortened back and thinned out every winter. Keep the ground as free from weeds as possible by frequent light tillage, and before the hot weather sets in mulch the surface soil as far as the roots extend. Propagation is effected by seeds, layers, grafting, or budding. Seedlings will often come fairly true, but still there is a doubt about them, and they are mostly raised from stocks. They should be sown in shallow drills as soon as the fruit is ripe and covered an inch deep. Next season the young trees should be planted in rows, leaving them 9 or 10 inches apart in the lines. The following year they will be ready for working. Layers strike freely, but as a rule they do not make such durable and well shaped trees as can be obtained by other means. Grafting and budding upon seedling stocks of their own species are the most generally practised methods for perpetuating particular varieties. These operations are performed in the same way and times as is suitable for other deciduous trees.

AGRICULTURAL SOCIETIES' SHOWS, 1897.

Society.	Secretary.	Date.
Dapto A. and H. Society	A. B. Chippendall	Jan. 6, 7
Albion Park A. and H. Association	H. Fryer ...	,, 13, 14
Gosford A. and H. Association	W. McIntyre ...	,, 29, 30
Wollongong A. and H. Society	J. A. Beatson ...	Feb. 3, 4
Cobargo A., P., and H. Society	T. Kennedy ...	,, 16, 17
Ulladulla P. and A. Society	C. A. Cork ...	,, 16, 17
Berrigan A. and H. Society	R. Drummond...	,, 17
Riverina P. and A. Society (Cereal)	W. Elliott ...	,, ——
Manning R. (Taree) A. and H. Association	H. Plummer ...	,, 18, 19
Lithgow A., H., and P. Society	J. Asher ...	,, 18, 19
Robertson Agricultural Society	R. J. Ferguson .	Mar. 2, 3
Bega A., P., and H. Society	J. Underhill ...	,, 3, 4
Southern New England (Uralla) P. and A. Association	Jas. Leece ...	,, 9, 10
Tumbarumba P. and A. Society	W. Willans ...	,, 9, 10
Tenterfield Intercolonial P., A., and M. Society ...	F. W. Hoskin...	,, 10, 11, 12
Coonabarabran P. and A. Association	E. May-Steers...	,, 11
Oberon A., H., and P. Association	A. Gale... ...	,, 11, 12
Berrima District (Moss Vale) A., H., and I. Society ...	J. Yeo	,, 11, 12, 13
Cobargo A., P., and H. Society	T. Kennedy ...	,, 16, 17
Crookwell P. and A. Association	W. P. Levey ...	,, 18, 19
Lismore A. and I. Society	T. M. Hewitt ...	,, 18, 19
Walcha P. and A.	F. Townsend ...	,, 23, 24
Cudal A. and P. Society	C. Schramme ...	,, 24, 25
Blayney A. and P. Association	J. Clements ...	April 1, 2
Mudgee A., P., H., and I. Association	J. Cox	,, 6, 7
Liverpool Plains (Tamworth) P., A., & H. Association	A. M'Leod ...	,, 6, 7, 8
Warialda P. and A. Association	W. B. Geddes...	,, 7, 8
Williams River A. and H. Association	W. Bennett ...	,, 7, 8
Cooma P. and A. Society	D. C. Pearson...	,, 7, 8
Orange A. and P. Association	W. Tanner ...	,, 7, 8, 9
Gulgong P. and A. Association	C. E. Hilton ...	,, 13, 14
Queanbeyan P. and A. Association	W. D. Wright...	,, 13, 14
Royal Agricultural Society	F. Webster ...	,, 14-20
Moree P. and A. Society	S. L. Cohen ...	,, 21, 22
Clarence P. and A. Society (Grafton)	J. Wilcox ...	,, 27, 28
Bathurst P. and A. Society	W. G. Thompson	,, 28, 29, 30
Hunter River (West Maitland) A. and H. Association...	W. C. Quinton	,, 28, 29, 30
Hay Hortic. Society...	J. Johnston ...	May 5
Namoi P. and A. Association (Narrabri)...	J. Riddle ..	,, 5, 6
Hawkesbury District Agricul. Association (Richmond)	C. S. Guest ...	,, 6, 7, 8
Upper Manning A. and H. Society	W. Dimond ...	,, 12, 13
Wellington P. and A. Society	R. Porter ...	,, 13, 14
Upper Hunter P. and A. (Muswellbrook)	J. C. Luscombe.	,, 19, 20, 21
Nyngan and District	E. H. Prince ..	June 1, 2
Brewarrina P. and A. Association	H. L. Cathie ...	,, 7, 8
Cobar P. and A. Association	W. Redford ...	,, 9, 10
Deniliquin P. and A. Society	H. J. Wooldridge...	July 13, 14
Hay P. and A. Association...	Chas. Hidgcock.	,, 22, 23
Riverina P. and A. Society (Jerilderie)	W. Elliott ...	,, 27, 28
Condobolin P. and A. Association...	H. W. Grey Innes.	,, 28, 29
Lachlan P. and A. Association (Hillston)	Thos. Cadell ...	,, 30
Gunnedah P., A., and H. Association	J. H. King ...	Aug. 3, 4
Forbes P., A., and H. Association	F. Street ...	,, 5, 6
Corowa P., A., and H. Society	E. L. Archer ...	,, 19, 20
Cootamundra A., P., H., and I. Association	T. Williams ...	,, 25, 26
Grenfell P., A., H., and I. Association	G. Cousins ...	,, 25, 26
Grenfell P. and A. Association	Geo. Cousins ..	,, 25, 26
Northern Agricultural Association	C. Poppenhagen	Sept. 1, 2

On Her Majesty's Service.

The Department of Agriculture,

SYDNEY.

SPECIMENS ONLY.

From ....

Address ....

(*By authority of the Department of Mines and Agriculture.*)

Society.	Secretary.	Date.
Murrumbidgee P. and A. Association (Wagga)...	... P. W. Lorimer..	Sept. 1, 2
Burrawong P. and A. Association (Young) ...	... C. Wright ...	,, 1, 2
Manildra Agricultural Society ... ... (Ploughing Match and Horse Parade.)	.... G. W. Griffiths..	,, 8
Albury and Border P., A., and H. Society ...	... Geo. E. Mackay	,, 8, 9
Murrumburrah P., A., and I. Association ...	... Miles Murphy...	,, 8, 9
Yass P. and A. Association	... Thos. Bernard...	,, 9, 10
Wallsend and Plattsburg A. H. P. P. and C. Society	... G. Gilmour ...	,, 9, 10, 11
Parkes P., A., and H. Association	... H. S. Harwood..	,, 15, 16
Junee P., A., and I. Association	... T. C. Humphrys	,, 15, 16
Burrowa P., A., and H. Association	... J. H. Clifton ...	,, 16, 17
Cowra P., A., and H. Association	... Fred. King ...	,, 22, 23
Temora P., A., H., and I. Association	.. W. H. Tubman.	,, 22, 23
Moama A. and P. Association	... C. L. Blair ...	,, 29
Narrandera P. and A. Association	... J. F. Willans ...	Oct. 6, 7
Berry Agricultural Association	... A. J. Colley ...	Nov. 24, 25, 26

1898.

Dapto A. and H. Society	... A. B. Chippendall	Jan. 12, 13
Albion Park A. and H. Association	... H. Fryer ...	,, 19, 20
Kiama A. Association	... J. Somerville ...	,, 25, 26
Wollongong A., H., and I. Association	... J. A. Beatson ...	Feb. 2, 3
Robertson Agricultural Society	... R. G. Ferguson..	,, 8, 9
Shoalhaven A. and H. Association	... R. C. Leeming...	,, 10, 11
Manning River A. and H. Association (Taree) ...	... H. Plummer ...	,, 10, 11
Ulladulla A. and H. Association (Milton) ...	... C. A. Cork ...	,, 16, 17
Southern New England P. and A. Association (Uralla)	J. D. Leece ...	Mar. 1, 2
Bega A., P., and H. Society	... J. Underhill ...	,, 2, 3
Upper Hunter (Muswellbrook) P. and A. Association...	J. C. Luscombe.	,, 2, 3, 4
Bombala Exhn. Society	... R. H. Cook ...	,, 8, 9, 10
Tenterfield Intercolonial P., A., and M. Society	... F. W. Hoskin...	,, 9, 10, 11
Cudal A. and P. Society	... C. Schramme ...	,, 10, 11
Inverell P. and A. Association	... I. McGregor ...	,, 10, 11, 12
Berrima District (Moss Vale) A. H. and I. Society	... J. Yeo	,, 10, 11, 12
Armidale and Glen Innes Combined New England District Show at Armidale.	J. Allingham ...	,, 16, 17, 18
Cumnock P. and A. Association	... Thos. Howard...	,, 17
Blayney A. and P. Association	... G. Pile, junr. (acting).	,, 17, 18
Goulburn A., P., and H. Society	... J. J. Roberts ...	,, 17, 18
Camden A., H., and I. Society	... W. R. Cowper...	,, 23, 24, 25
Bathurst A., H., and P. Association	... W. G. Thompson	,, 23, 24, 25
Orange A. and P. Association	... W. Tanner, junr.	,, 30, 31, April 1
Molong A. and P. Association	... P. F. A. Kinna..	April 5, 6
Royal Agricultural Society of N.S.W.	... F. Webster ...	,, 6-12
Richmond River A., H., and P. Society (Casino)	... Jas. T. Tandy...	,, 14, 15
Hawkesbury District Agricultural Association ...	... C. S. Guest ...	May ——

Secretaries of Societies are asked to forward dates of forthcoming Shows as soon **as decided.**

[Three **plates.**]

Acacia aneura, F. v. M.

"Mulga."

Useful Australian Plants.

BY J. H. MAIDEN,
Government Botanist and Director of the Botanic Gardens, Sydney.

No. 40.—THE MULGA (*Acacia aneura*, F.v.M.)

[A fodder plant.]

Vernacular and Aboriginal Names.—It is the chief ingredient of Mulga scrub. "Mulga" is the name of a long narrow shield of wood, made by the aborigines out of this and other Acacia woods. It is sometimes known as "Myall," but must not be confused with the true Myall, *Acacia pendula*. "Mulkathandra," is the name given to the seeds by the Dieyerie tribe of Cooper's Creek, according to Gason.

Botanical Names.—*Acacia*, already explained; *aneura*, from two Greek words *a* not, and *neuron* a nerve, in allusion to the veins or nerves of the leaves (*phyllodes*), "without conspicuous nerves, but finely and obscurely striate under a lens."

Seeds.—The name given to these seeds by one tribe of aborigines has been already quoted. They were eaten by these blacks, and continue to form part of the food of some aborigines to this very day. I need scarcely say that they are astringent, and that they yield only a small proportion of starchy matter.

Leaves.—The leaves, or rather phyllodia, for in strictness they are not true leaves, but structurally expansions of the leaf-stalks, form excellent food for stock. In fact, some people call the plant the "king of fodders," and it has been so much appreciated that it is now scarce in many districts where it was once plentiful. Sometimes this plant is exempted, in certain districts, from the operations of licenses to cut timber. It is a matter for regret that so valuable a fodder-plant should require to be cut for timber at all, and it is to be hoped that increased vigilance will be shown, on the part of homestead lessees and others, in their own interests, in conserving the Mulga. Mulga should never be cut down except when absolutely necessary; it should only be pollarded or lopped; and if these operations be performed by careful men no real harm to the tree will result. One reason why the tree is becoming extinct in some areas is because the seedlings are eaten out by stock. This is a matter for regret, and of course the only way of guarding against this is to protect as many of the seedlings as possible until they are able to take care of themselves. It does not appear to be known to some dwellers of the more highly favoured coast districts that in some seasons in parts of the west there is practically no grass at any period of the year, and that stock not only feed on scrub-plants such as the Mulga, but actually thrive thereon.

Exudation.—The Mulga yields a small quantity of soluble gum, similar in properties to that of good gum-arabic. It would be commercially valuable if it were procurable in quantity.

Bark.—A specimen of the bark of this tree from Ivanhoe, *via* Hay, New South Wales, yielded 4·78 per cent. of tannic acid, and 10 per cent. of extract. A narrow-leaved variety from the same neighbourhood yielded 20·72 per cent. of extract, and 8·62 per cent. of tannic acid. The former was a deeply-furrowed, flaky, pulverulent bark, apparently from an old tree; average thickness, ⅜ inch. The bark of the narrow-leaved variety is a thin, poor bark, not exceeding $\frac{3}{16}$ inch in thickness, moderately fissured, of a dark-grey colour, sometimes nearly black. (*Proc. R.S., N.S.W.*, 1887, p. 32).

A second sample of the normal species gave (*Proc. R.S., N.S.W.*, 1888, p. 271) 2·32 per cent. of tannic acid, and 12·12 per cent. of extract. It was from Tarella, Wilcannia; collected August, 1887; analysed August, 1888. A useless, flaky, dry-country bark.

Timber.—Excessively hard, dark-brown, used by the aborigines for boomerangs, sticks to lift edible roots, shafts of spears, nulla-nullas, and jagged spear-ends (Mueller). It is highly irritating in flesh wounds. It makes excellent fencing-posts, and in parts of western New South Wales it is very plentiful, and much appreciated. It is often used for bullock yokes.

Size.—Diameter up to 9 or 12 inches, and height 20 to 30 feet.

Distribution.—Western Australia, through the other mainland colonies to Queensland. It is a native of the drier western parts of the Colony. Its precise eastern boundaries are not yet defined.

Insect Life.—Two kinds of galls are commonly found on the Mulga. One kind is very plentiful, very astringent, and not used; but the other, while less abundant, is larger, succulent, and edible. The latter galls are called "Mulga apples," and are very welcome to the thirsty traveller.

Reference to Plate.—The Plate shows the broad and narrow-leaved forms, reduced in size. A. An individual flower, much enlarged; B. A pod, with one valve removed.

No. 41.—Salt Grass (*Distichlis maritima*, Rafin.)

Botanical Name.—*Distichlis*, Greek, *distichos* of two rows, referring to the leaves which are so placed; *maritima*, Latin, belonging to the sea, this being a coast grass.

Synonym.—*Festuca distichophylla*, Hook. f.

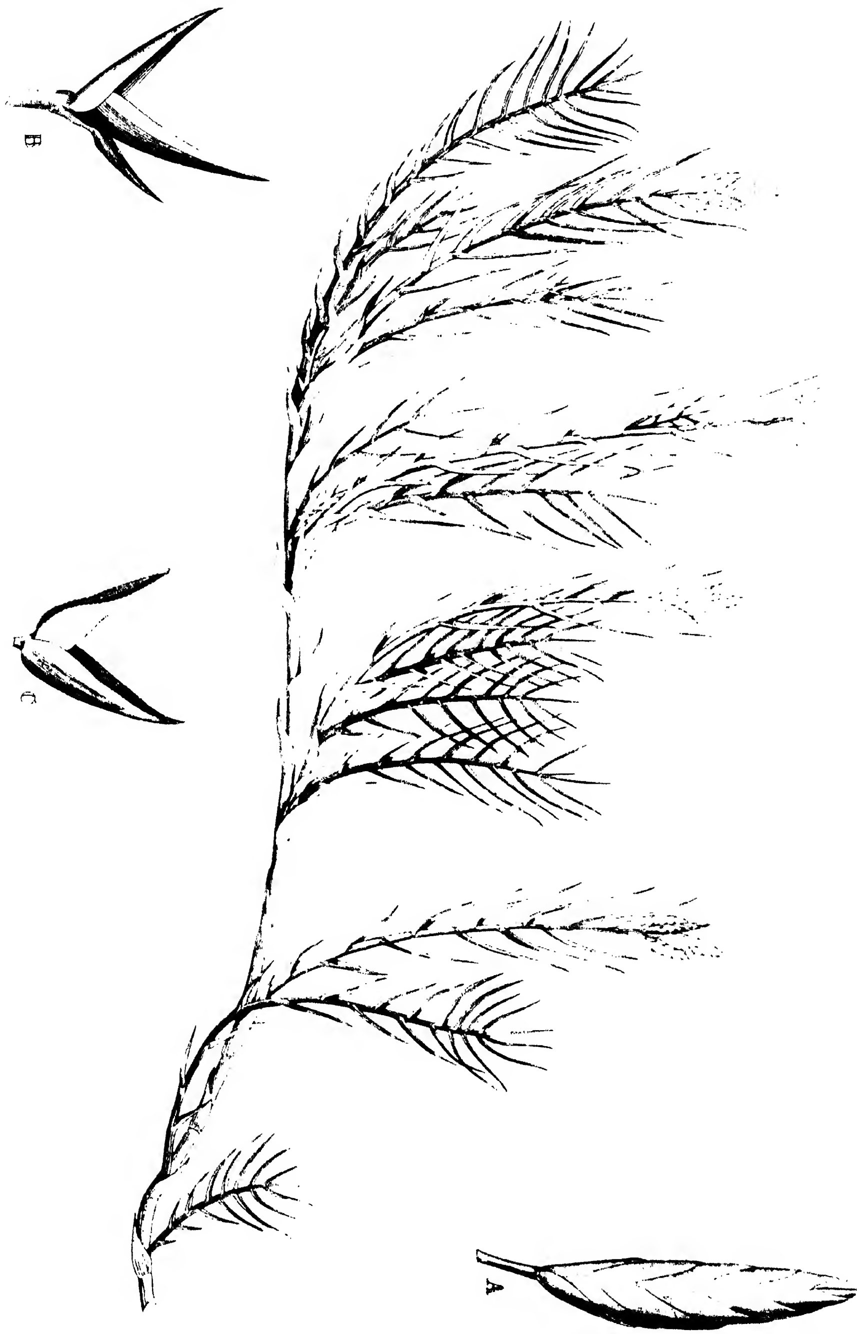
Vernacular Names.—"Salt Grass" and "Alkaline Grass" of the United States; "Spike Grass" and "Quack Grass" are also American names. The first two names are in allusion to the saline land in which this grass will flourish. I do not know any name which has been adopted in these Colonies, and suggest that "Salt Grass" is as good as any.

Where figured.—Vasey; Labillardière as *Uniola distichophylla*.

Botanical description (B. Fl. vii, 637).—A rigid, glabrous, much-branched grass, forming broad, low, leafy tufts, the branches sometimes growing out to 1 foot, covered to the inflorescence with the leaf-sheaths.

Leaves narrow, rigid, very acute or pungent-pointed, usually distichously spreading.
Spikelets few, two or three in the females, rather more in the males, six to nine lines long in the Australian specimens, rather smaller and more numerous in some American ones, flat but rather thick, 8 to 12-flowered.
Glumes closely imbriate, about 3 lines long, rather rigid and straw-coloured.
Anthers (in the males) long.
Stigmas (in the females) protruding from the end of the glumes.

Value as a fodder.—Although this cannot be considered a first-rate grass for agricultural purposes, it is freely cut with other marsh grasses, and on the



Distichlis maritima, Rafin.

"Salt-grass"

Chamæraphis paradoxa, Poir.

A "Mud-grass"

alkaline plains of the Rocky Mountains of the United States it affords an inferior pasturage. (Vasey.)

This dwarf-creeping grass is of great value for binding soil, forming rough lawns, is useful for edging garden plots in arid places, and covering coast sand. (Mueller.)

In our own Colony it has no recognised pastoral value, but it is undoubtedly useful as a sand-binder, consolidating land close to the edge of the sea, and affording a bite for stock in such localities. Of its comparative nutritive value we know nothing, but judging from its harsh nature, it does not promise much.

Habitat and Range.—A sea-coast grass found in all the Colonies except Western Australia and Queensland.

"Grows in marshes near the sea-coast on both sides of the American Continent, and also abundantly in alkaline soil throughout the arid districts of the Rocky Mountains." (Vasey.)

"Prospectors and miners in California consider its presence a sure sign of water near the surface, and when crossing the desert select spots where it grows to dig for water." (Orcutt.)

Reference to Plate.—A. The spike-like inflorescence, showing the closely-imbricate glumes; B. C. Two pairs of the lowest glumes from an immature female plant.

No. 42.—A Mud-grass (*Chamæraphis paradoxa*, Poir.)

[A moisture-loving grass, which has received no common name.]

Botanical Name.—*Chamæraphis*, Greek, *chamai* for "on the ground," and *raphis* a needle, referring to the awn-like point of the rhachis; *paradoxa*, Latin adjective, "something unusual or unexpected," a name first given by this grass to Robert Brown, who called it *Panicum paradoxum*, as it was abnormal in comparison with other species of that genus.

Synonym.—*Panicum paradoxum*, R. Br.

Botanical description (B.Fl. vii, 499):—

A smaller plant than *C. spinescens*.

Leaves mostly short and spreading.

Panicle almost reduced to a simple, spike-like raceme, the awn-like branches mostly bearing only a single spikelet near the base, the lower ones only occasionally more elongated with the two distant spikelets, the rhachis always produced into a long awn exceeding the spikelet.

Spikelets acuminate, 4 or 5 lines long.

Outer glume broad, thinly membranous, about ½ line long, the second and third glumes nearly equal, striate with many nerves; fruiting glume oblong, acute, nearly 2 lines long, thin, and almost nerveless.

Value as a fodder.—Will flourish only in damp situations, and in favourable places will furnish a mat-like mass of nutritious fodder. These moisture-loving plants are frequently not appreciated to the extent they deserve, because the uncomfortable situations in which they are found render careful examination and continual observation of them difficult for the greater part of the year.

Habitat and Range.—Semi-aquatic; occurs from Victoria and Queensland. In our Colony it extends from the coast district to the table-land. It is not uncommon around Port Jackson.

Reference to Plate.—Portion of a panicle, enlarged; B. A spikelet, showing the rhachis produced into an awn longer than the spikelet; C. Grain.

Botanical Notes.

Pomaderris apetala, Labill., as a Fodder Plant.

This is a tall hazel-like shrub or small tree found in the coast districts. I have frequently observed this plant to show signs of being nibbled by stock, and on mentioning the matter to Mr. A. W. Howitt he informed me that it is a regular stand-by in winter for cattle in Gippsland, Victoria. It belongs to the *Rhamnaceæ*.

Templetonia egena, Benth., as a Fodder Plant.

The following interesting letter is from Mr. A. N. Grant, of Hillston. *Templetonia egena* is a broom-like shrub belonging to the pea family (*Leguminosæ*) and found in the western part of the Colony.

"This plant is a capital summer feed for merino sheep brought up in the district in which it grows. I at one time sent a specimen to the late lamented Baron von Mueller calling it when I did so Australian Broom. He gave me the proper name. He also asked why I called it Broom*. I replied that it was because for a little time when a seedling it had a trefoil leaf, but only for a little time, and also because it had only one, and sometimes, but rarely, two seeds in each little pod. I do not think cattle or horses care about it. I have had no opportunity of knowing whether camels or goats would subsist on it, but I think the latter would. It is, I am sure, splendid feed for merinos in summer, as it is not too salt and contains some sap. It consequently is a boon where water is scarce."

The Brushy Mountain.

[Previous reference, 1895, 589.]

The following plants, sent by Jesse Gregson, Esq., are to be added to this particular locality.

CAPPARIDEÆ.

Capparis nobilis, F.v.M.

LEGUMINOSÆ.

Acacia longifolia, Willd.

COMPOSITÆ.

Helichrysum Bidwilli, Benth.

PHYTOLACCEÆ.

Codonocarpus australis, A. Cunn.

---

* This plant is usually called Australian Broom, because of its resemblance to the common Broom of Europe, *Sarothamnus scoparius*.

The Dorrigo Forest Reserve.

[Previous reference, 1896, 38.]

I give the following notes on two important plants from this locality. They were sent by Mr. Forester Macdonald in September, 1896, but he has since been transferred to another district, and collecting in this locality has in consequence been interrupted.

RUTACEÆ.

Bosistoa euodiformis, F.v.M.

LAURINEÆ.

Tetranthera (*Litsæa*) *reticulata*, Meissn.

Plum Tree.

A huge timber tree on the Dorrigo, with peculiar blotched patches on the bark.

The "Brush" of Wheat Grains.

By N. A. COBB.

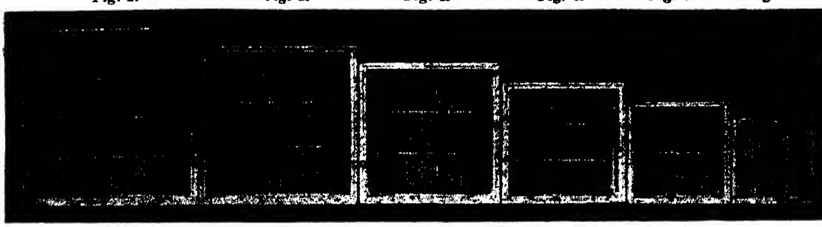
FROM time to time during the last five years I have given some little attention to the character and size of the "brush" in the different varieties of wheat, with the object of discovering whether it presented any characters that would assist in the identification of varieties. So long ago as the early part of 1893, in writing original descriptions of the Australian varieties of wheat, I made use of this character, noting whether on the whole the brush appeared prominent or otherwise on casual observation. A revision of the work decided me to go into this matter more carefully. Accordingly, Mr. E. M. Grosse assisting me by preparing the specimens and making the drawings, I have measured the area of the brush on five averaged-sized grains of each of the following varieties:—

Thomas' R.R.
White Fife.
Leak's R.R.
Northern Champion.
Sicilian Square-headed Red.
Darblay's Hungarian.
Bearded Hérisson.
Anglo-Australian.
Fultz.
Hedgerow.
Rieti.
Talavera de Bellevue.
Ward's Prolific.
Dallas.
Battlefield.
Improved Fife.
Saskatchewan Fife.
White Velvet.
Marshall's No. 3.
Little Club.
Frampton.
Early Para.
King's Jubilee.
Australian Talavera.
Red Straw.
Velvet Pearl.
Rattling Tom.
French Early Bearded.
Robins' R.R.
Canning Downs R.R.
White Lammas.
Early Baart.
White Naples.
Steinwedel.
Allora Spring.
Farmer's Friend.
Zealand.
Oakshott's Champion.
Steer's Early Purple Straw.
Blount's Lambrigg.
Marshall's No. 8.
White Essex.
Fillbag.
Pringle's Defiance.
Golden Drop.
Hudson's Early Purple Straw.
Rattling Jack.
Dutoits.
Gore's Indian.
Brown-eared Mummy.
Algerian.
Poland.
Belotourka.
Medeah.

This list includes the varieties of wheat principally grown for flour, in this as well as other countries. There need be no mistake about the exact nature

of the samples tested if reference be made to the descriptions published in the *Agricultural Gazette* of New South Wales, 1893, pages 431 to 471, where these varieties are as fully described as the limits of our knowledge then permitted. The results herein presented thus rest on a definite basis, because the names of the samples tested represent definite varieties in a state of purity.

Fig. 1. Fig. 2. Fig. 3. Fig. 4. Fig. 5. Fig. 6.

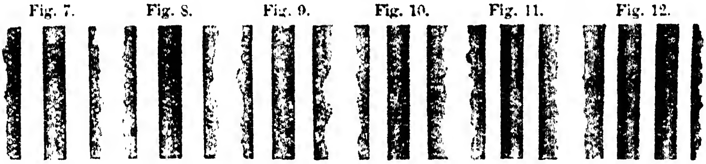


225. 255. 275. 300. 200 325.

Figures of six sieves described in the text, and used for grading wheats. The sieves are square wooden frames, carrying sieve bottoms made of half-round brass wire soldered in place to one, two, or three cross wires. The proper grade number is placed below each of the figures, which are about one twenty-fifth full size.

The nature of the sample tested was in all cases noted, and pains was taken to select grains of average size and quality. In order to ensure the results being comparative, the samples of grain to be tested were first graded by means of sieves, such as are shown in the accompanying figures 1 to 6. The meshes of the sieves are elongated, their width being graduated most carefully from three and a quarter millimetres down to two millimetres, the

Fig. 7. Fig. 8. Fig. 9. Fig. 10. Fig. 11. Fig. 12.



325. 300. 275. 250. 225. 200.

Figures showing the exact size of the meshes of the sieves shown in Figures 1 to 6.

different grades being known as 325, 300, 275, 250, 225, and 200, meaning 3·25 millimetres, 3·00 millimetres, 2·75 millimetres, 2·50 millimetres, 2·25 millimetres, and 2·00 millimetres. These six sieves give seven grades of wheat, to which the corresponding mesh-numbers are given. The grain

Fig. 13. Fig. 14. Fig. 15. Fig. 16. Fig. 17. Fig. 18. Fig. 19.

325. 300. 275. 250. 225. 200. Rubbish.

Figures showing the size of the grains belonging to each grade yielded by the sieves shown in Figures 1 to 6. The proper grade numbers are placed below each illustration.

coming through the 200-mesh is called rubbish. Grains of these various grades are here shown. As soon as a sample was sieved it would be seen

that the bulk of the sample was of one grade, as, for instance, the 250-grade· Grains were selected from this grade for measuring. Where the sample on being sieved gave an equal quantity of two grades, both grades were used.

Rubbish. 200. 225. 250. 275. 300. 325.

Fig. 20.—Half a peck of wheat graded by means of the sieves shown in Figures 1 to 6. The piles show the relative amount of each grade. The grade numbers are placed under each pile.

As the matter was one of minor importance only one year's crop was examined. The following table must, therefore, be taken as only approximately correct. The varieties having a small brush are placed first, those with a large brush last.

VARIETIES OF WHEAT arranged according to the size of the brush of the grain.

1. Sicilian Square-headed Red.
2. Gore's Indian.
3. Brown-eared Mummy.
4. Hedgerow.
5. Thomas's R.R.
6. White Fife.
7. Canning Downs.
8. Allora Spring.
9. Little Club.
10. French Early Bearded.
11. Northern Champion.
12. Poland.
13. Velvet Pearl.
14. Early Para.
15. Saskatchewan Fife.
16. Early Baart.
17. Ward's Prolific.
18. Pringle's Defiance.
19. Robin's R R.
20. Leak's R.R.
21. Fultz.
22. White Lammas.
23. Improved Fife.
24. Darblay's Hungarian.
25. White Essex.
26. Steinwedel.
27. Marshall's No. 8.
28. California Spring.
29. Dallas.
30. Red Straw.
31. Dutoits.
32. Belotourka.
33. White Velvet.
36. Anglo-Australian.
37. Fillbag.
38. Medeah.
39. Zealand.
40. Marshall's No. 3
41. White Naples.
42. Frampton.
43. Cape.
44. Rieti.
45. Hudson's Early Purple Straw.
46. Rattling Tom.
47. Oakshott's Champion.
48. Battlefield.
49. Steer's Early Purple Straw.
50. Talavera de Bellevue.
51. Australian Talavera.
52. Golden Drop.
53. Rattling Jack.

In order to arrive at results useful in determining varieties from the foregoing data, it will be necessary to compare the size of the brush with that of the grain, so as to bring out clearly the relative size of the brush.

Let us turn, therefore, to the table giving the relative sizes of the grains in the different Australian varieties of wheat as worked out at the Government Experiment Farm at Wagga in the years 1893–4, and published in this *Gazette* in 1895.

SIZE TABLE.—Varieties of Wheat, arranged according to the size of their grains. Average of two crops.

Poland	91·9	White Naples	67·7	Californian Spring	51·2
Rieti	80·0	Talavera de Bellevue ..	66·6	White Velvet	50·5
Algerian	79·0	Early Para	65·1	Blount's Lambrigg	50·3
Australian Talavera.. ..	77·7	Steer's Early Purple Straw..	63·9	Darblay's Hungarian ..	50·0
White Lammas	76·3	Steinwedel	63·7	Improved Fife	49·3
Marshall's No. 8	76·0	Farmer's Friend	63·2	Little Club	48·7
Zealand	74·6	Golden Drop	61·8	White Fife	48·6
Red Straw	73·1	Leak's R. R.	58·5	Gore's Indian	48·4
Marshall's No. 3	71·4	White Velvet	57·9	Fultz	47·3
Early Baart	71·0	Canning Downs	56·0	Bearded Herrisson	46·1
Rattling Jack..	70·5	Allora Spring..	55·6	Velvet Pearl	44·8
White Essex	70·4	Brown-eared Mummy ..	53·8	Sicilian Square-headed Red	44·1
Hudson's Early Purple Straw	70·0	Fultz	53·1	Hedgerow	42·9
Belotourka	68·8	Anglo-Australian	53·1		

From a comparision of the positions occupied by any given name on the two lists it is easy to determine such facts as the following:—

1. Early Baart, in proportion to size of its grain, has a very small brush. To a greater or less extent, the same is true of the Poland, Early Para, Canning Downs, &c.
2. Velvet Pearl, in proportion to the size of its grain, has a large brush; so have the Fifes, Rattling Jack, &c.

Other facts more or less interesting to those who have to deal in wheat may be derived from these tables—facts of sufficient value to warrant their publication, though they are regarded only as minor incidentals to the main work on wheat being carried out at Wagga.

The composition of the brush will be dealt with in a separate article, which is nearly ready.

Coccids (Scale Insects) in Sydney Gardens.

WALTER W. FROGGATT,
Government Entomologist.

As the dispersal of these destructive creatures, popularly know as "scale insects," is of great interest, not only to every citizen who cultivates a plot of ground, but a danger to every orchardist in the Colony, it is not out of place to give some account of the *Coccidæ* found upon the plants growing in the gardens around Sydney.

The spread of scale insects, in spite of the females being wingless and stationary or sluggish in their movements, is easily accounted for in their earlier stages by the immense number of young larvæ produced by each adult female, and the wind blowing the leaves about could carry the minute larvæ a considerable distance; others may go even further by falling upon a person's clothes when moving among infested plants, while it has been proved that birds can carry away the scale and aphis upon their feet and legs, and thus transport such pests into clean trees.

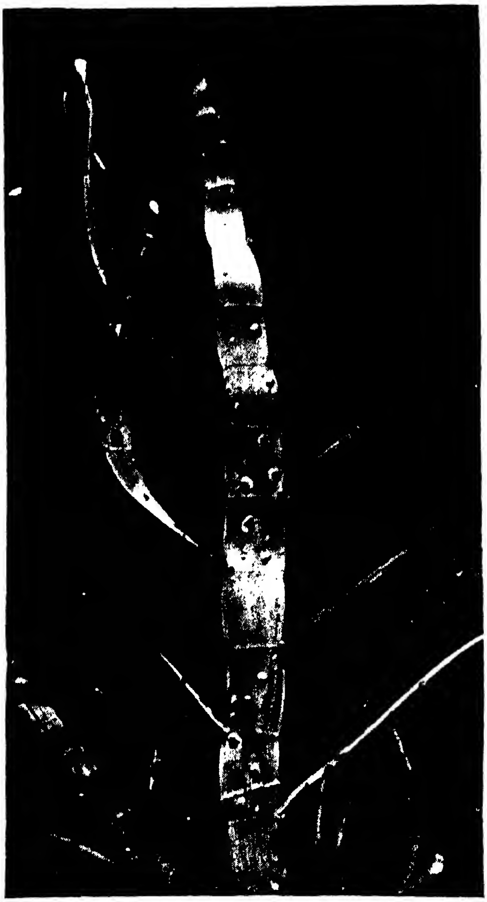
Importations of trees and plants from foreign countries should be carefully examined before they are planted out, and all packing and wrappers should be burnt as soon as removed, for there is not enough care taken either by business men or private importers in seeing that their introduced plants are disinfected and cleaned before planting out.

We have a great number of the cosmopolitan scales in this country, but there are a large number still unrecorded from New South Wales, and even at this late hour it would be advisable for the Government to quarantine all foreign plants until they have been examined.

Aspidiotus nerii, Bouche.

This is a cosmopolitan and omnivorous species that has a world-wide reputation, but is probably a native of Europe. It was described as far back as 1833 (Schadl. Gart. Ins., 1833–52).

In America, some twenty years ago, it attacked the citrus orchards of California, and Professor Comstock, in the Entomological Report, Department of Agriculture, U.S., 1880, says, that "specimens of infested lemons from Europe were forwarded to him from a correspondent in San Francisco, who had imported them from the Mediterranean. Notwithstanding the great distance (once across the Atlantic and twice across the continent) which this fruit had been transported, the insects infesting it were alive and in a healthy condition." In America it has also been found upon acacia, magnolia, oleander, maple, plum, cherry, and other trees. Maskell says that in New Zealand it is found upon *Coprosma lucida* and *Corynocarpus lævigatus*; in



PALM SCALE.
(*Lecanium tesselatum*, Sign.)

Aspidiotus nerii, Bouche.

the Sandwich Islands upon apple and pear; and in Australia upon acacia, oleander, and citrus, &c. I have found it in a Sydney garden on a cherry laurel, a fine Eugenia is nearly killed with it, while in the bush on the Cooper Estate at Rose Bay I found a macrozamia white with its scales.

The adult female scales are almost circular, flat and white, with the exuviæ of a green to brown colour rising up in the centre. They measure from half a line to a line in diameter, and cluster together, their edges being in contact when the plant is badly infested, and they are generally most numerous upon the underside of the foliage.

Aspidiotus aurantii, Maskell (Red Scale).

This scale was described by Maskell in 1878 in the Transactions of the New Zealand Institute upon oranges imported into New Zealand from New South Wales, and if this country is its home it has spread with remarkable rapidity. According to Maskell it is also found "in New Zealand, Fiji, Sandwich Islands, Samoa, Tonga, and New Caledonia upon *Citrus;* and upon the same trees in many other countries; in California and Jamaica upon *Eucalyptus, Lignum vitæ*, &c." In the Botanic Gardens it has been found on the foliage of *Olea americana*; in orchards and gardens about Sydney upon orange, lemon, and other shrubs. Comstock found this insect very plentiful in California soon after Maskell had described it, and redescribed it under the name *Aspidiotus citri* in the *Canadian Entomologist*, but finding the latter's paper he sent over and received specimens from Maskell with which he identified his species.

This is our common scale upon orange and lemon trees, chiefly found upon the leaves and fruit, and is one of the most persistent species to destroy, as it clings so close to its food plant. In South Australia fruiterers are fined for selling oranges covered with this scale, but in Sydney shops one can hardly find an orange which is not more or less infeste

Ceroplastes ceriferus, Anderson.

This scale is one of our commonest garden pests in the neighbourhood of Sydney, attacking nearly all the shrubs with smooth thick leaves, and in many places it has spread into the bush, where its chief food plant appears to be *Busaria*, though it attacks many others down to the bracken ferns.

This is an introduced scale, whose home is the jungles of Southern and Central India. It was described as far back as 1790 by Dr. Anderson in a paper entitled "*Monographia cocci ceriferi*," Madras. He sent a lot of the wax secreted by the scale obtained upon the twigs of *Celastrus ceriferus* to Dr. Pearson,* who analysed it and produced a wax, which, made into candles, burnt freely, and gave a good light, but were very smoky and produced a resinous smell.

An account of this Coccid was given by Professor Westwood in the *Gardeners' Chronicle*,† who figured the waxy test produced by the female. Signoret reproduced this with notes in the *Annals de la Soc. Entom.* of France.‡

In 1892 Mr. Maskell§ gave a detailed description and figures of this coccid, which he had received from the Director of the Indian Museum, who had obtained them from the Kangra Valley, where they had been found in small numbers upon tea plants. He also had specimens from Mr. Olliff and

* Philo. Trans. Roy. Soc., London, p. 383, 1794. † G. C., p. 48 1853.
‡ Ser. 5, vol. ii, p. 40, 1872. § Trans. New Zealand Institute, p. 216, 1893; xii, fig. 111

Mr. Koebele, found in Australia upon *Melaleuca hypericifolia* and other plants.

In a very interesting paper,* by Mr. Cotes, "White Insect Wax in India," to which I am indebted for the record of this coccid in its native home, he states it is a comparatively rare insect. Those described by him were taken by Mr. Thomas, the Deputy Conservator of Forests, Hoshangabad, Central Provinces, who found them upon two species of *Terminalia* and a *Buchanania*, and wrote "that the insect was very scarce, and only found after long search, while the natives knew nothing about it."

In 1875 Mr. Peppe† forwarded specimens which had been found upon *Pepal* twigs in Chola, Nagpur, and stated that he had found them upon mango and Ayoon trees.

This is another instance of an introduced pest, comparatively rare in its native land, which, when transported into suitable surroundings, multiplies with startling rapidity, unchecked by the parasites or other causes which keep it within bounds in India.

I have never found anything attack these scales, or been able to breed parasites from the adult coccids kept for months in glass-topped boxes. None of our ladybird beetles (*Coccinellidæ*) will touch them, and the waxy test seems to be an effectual barrier to the attacks of all small parasitic wasps and flies.

There is no mistaking the "Indian wax scale" when it is met with, for we have no indigenous species that forms such a mass of enveloping, greasy secretion, that crushes readily in one's fingers.

When immature the little scales are produced into pointed pinnacles, but when adult they measure about 4 lines in diameter. The summit is flat and rounded, with a raised rim, forming a ledge round the margin, sloping down on the sides.

The coccid is reddish-pink, but this is never seen except from the under-surface, as it is thickly enveloped in a mass of white to pale yellow waxy secretion.

This scale is not known in Victoria or South Australia, but is found in Brisbane. I saw a native tree at the Wollongbar Experiment Farm, growing near the house, whose leaves had been devoured by some caterpillars, and it was coated so thickly with this scale that it looked as if it had been white-washed at a distance. Cockerel in his list gives twenty-six species of this genus—three from India, one African, two from Australia, and the bulk of the others Neotropical.

The following are some of the trees attacked in the Sydney district :—

Podocarpus elongata	*Randia chartacea.*
Achras costata	*Eugenia Smithii*
,, *australis*	*Gardenia florida*
Pittosporum eugenioides	*Burchellia capensis*
	Escallonia macrantha

Ceroplastes rubens, Maskell.

This coccid was described by Mr. Maskell in the Transactions of the New Zealand Institute,‡ from specimens received from Mr. Koebele, found upon a mango and a fig at Brisbane (Q.).

* Indian Museum Notes, vol. ii, No. 3, 1891. † Journ. of the Agri., Horti. Soc. of India, vol. v, p. 76. ‡ 1892, p. 214, pl. xii, figs. 6-10.

INDIAN WAX SCALE.
(*Ceroplastes ceriferus*, And.)

RED SCALE.
(*Ceroplastes rubens*, Mask.)

In 1894 I found a few specimens upon a mangrove in George's River, near Como, and the following year again found it upon the leaves of a lily-pilly (*Eugenia Smithii*), about 2 miles from Manly.

Early last December Mr. J. H. Maiden called my attention to a mango tree growing in the Botanic Gardens, every leaf of which was more or less covered with these scales. At that time I also found it upon about half-a-dozen trees within the immediate vicinity of the mango.

As *Ceroplastes rubens* is known during the last few years as a very destructive scale in Queensland, in orchards and gardens, while outside the Botanic Gardens (except the few at Manly) it is unknown in New South Wales, it is to be hoped that we will be able to keep it from spreading.

This scale is somewhat smaller than the wax scale, measuring about $2\frac{1}{2}$ lines in diameter; of a general pinkish-red colour; of the same rounded form and corrugated in the summit, which forms a dome-shaped centre, projecting above the raised outer margin. They are not covered with a waxen test, but the hard epidermis is marked with short transverse bars of white, which give them a mottled appearance. This scale always follows the ribs of the leaf, in some plants not only clustering along the mid-rib, but following up the transverse ones, and forming a regular pattern. The following are some of the trees infested in the Sydney district:—

Brassaia actinophylla	*Randia fitzalani*, F. v. M.
Aralia platanifolia	*Poinsettia pulcherrima*
Eugenia Smithii	*Berberis Leschenaultii*
Ilex latifolia	*Diervilla Lavallei*
,, *tarrago*	*Magnolia purpurea*
Cargillia australis	*Prunus lauro-cerasus*
Panex colensoi, Hook.	*Tupidanthus calyptratus*

Dactylopius aurilanatus, Maskell.

This insect was described by Maskell in the Tranactions of the New Zealand Institute, 1889, from specimens found upon *Araucaria bidwilli* and *A. excelsa*, growing at Auckland, New Zealand.

Towards the end of last February Mr. Maiden sent me a branch from one of the historic Norfolk Island pines (*Araucaria excelsa*) in the Botanic Gardens, covered with adult females of this scale. At this date the branches of twc of these trees were literally smothered as far as one could see upwards, the under-surface of each spray being quite white, and the needles towards the tips of the lower branches were all falling off.

Upon close examination I found that the coccids were infested with the larvæ of the "Green golden-eye (*Chrysopa ramburii*, Schnider), but was much surprised only two months later, when I again visited the trees for fresh specimens, to find that every adult female had vanished, the branches being covered instead with the little white cocoons of the pupæ of this pretty little chrysopa.

Upon the 7th of May, however, I again came across the scale upon the foliage of two other conifers, namely, *Dammara ovata* and *D. vitensis*. They were chiefly small females, though some were fully developed and laying eggs, but all showed the bright yellow markings very distinctly.

This is a very distinctive scale, measuring when adult about one line in diameter, and is rounded and corrugated upon the dorsal surface, of a general deep purple-black colour, brightly barred with a flowery secretion that forms a line down the centre of the back and round the outer margin of

the scale, of a bright yellow colour. In some cases there is a second bar on either side of the back, but it is never as distinct as the central one, and often wanting.

Lecanium oleæ, Bernard.

This coccid was described by M. Bernard in the Mem. d'His. Nat. Acad., 1872, and in the following year was again described by Signoret in the Annales de la Société Entomologique de France, who states that in that country it chiefly infests the olive trees. Comstock gives an account of this scale in America, in the Entomological Report of the U. S. Department of Agriculture for 1880, and Packard in the Fifth Report of the Entomological Commission, 1886-90.

In Los Angeles he says he has "found it on oranges, all other citrus plants, on olive, pear, apricot, plum, pomegranate, Oregon ash, bitter-sweet apple, eucalyptus, sabal palm, Californian coffee rose, Cape jessamine, *Halrothmus elegans*, and elsewhere upon an Australian plant known as *Brachæton*, and also upon a heath."

In America it has a good many parasites, one of which, a small chalcid wasp (*Dilophogaster californica*, Pack), destroys an enormous number of their eggs, while many lady-bird beetles also help to keep them in check.

Maskell, in the "Transactions of the New Zealand Institute, 1884," and in his "Scale Insects of New Zealand, 1887," says that it attacks *Camellia japonica* and native trees in that country, and in the Sandwich Island, goes upon *Citrus*, *Psidum*, &c.

In New South Wales it is one of our commonest scales. In orchards it is found upon orange, lemon, and apricot trees, and is very destructive to passion-vines; in gardens it is very partial to gardenias, pittosporums, and in the bush is found upon *Sida retusa*, *Busaria spinifera*, and a number of weeds. Not only is it a serious pest to the plants attacked, but by the secretion of honeydew, and the after effects of a growth of fumagine which covers the whole of the attacked tree with a coating of black soot, like fungus; it renders them most unsightly.

Fortunately, in the orchards this scale has many enemies, two species of (*Coccinellidæ*)—*Orcus chalybens*, Bois., a handsome metallic steel-blue coloured little beetle, and *O. Australasiæ*, a larger species of the same deep colour, but spotted with yellow, destroy an immense number of this scale. Last March there were thousands of both species in the orange orchards about Liverpool. Then the voracious larva of the pretty little Noctuid moth *Thalpochares coccophaga*, Meyr., a short rounded grub, which constructs a covering of the empty skins of the Lecanium, under which it crawls about upon the infested branches, devours all the scale that comes in its way, and, when full grown, pupates under this curiously constructed cocoon. The moth is of a delicate greyish-brown colour, the outer edges of the wings darkest, and the hind wings lighter coloured, with a wing expanse of slightly under an inch. As this moth in its native state chiefly infests the different species of *Ericococus* that are common upon the branchlets of eucalypts in most parts of Australia, it has not yet made its way into gardens about the town; but in orchards about Gosford, in the forest country, I found numbers of them upon the orange trees in November, where they were rapidly clearing off the black scale.

This scale is very plentiful in one Sydney garden, both on young stock and some of the large trees, while few of its parasites are found there, so that it is one of our scales that does not spread very easily. In its earlier stages it is dull white, gradually getting brown and wrinkled, but when mature is more rounded, and dark-brown to almost black in colour.

Lecanium tesselatum, Signoret.

This scale was described by Signoret in the same paper as the last species. His specimens were obtained from Montpellier, up the foliage of a palm (*Caryota ursus*). Maskell gives a general account of this species in the "Transactions of the New Zealand Institute, 1892," upon specimens received from Mr. Koobele, found upon *Laurus nobilis*, at Sydney, and in 1894 records it from Adelaide, S.A., from Mr. Quinn, who found it upon palms in hot-houses.

This is a very distinct species of *Lecanium*, and of a dark-chocolate to reddish-brown colour when mature, but pale brown in the earlier stages. The adult females are longer than broad (about $1\frac{1}{2}$ lines in breadth), very much flattened, and slightly arcuate at the apex in some specimens. They are very plentiful about Sydney, flourishing upon a number of different palms, but most plentiful upon the foliage of that curious Solomon Island plant, *Coccoloba platyclada*, and all of these bushes that have come under my notice are thickly covered with these scales in all stages of growth. The manager of one of the leading nurseries at Botany informs me that they notice it upon many palms, and also upon *Tabernæmontana comassi*, and it has also been found upon this tree and *Aglaia adorata* in the Botanic Gardens.

Fiorinia camelliæ, Comstock.

This species was described in Comstock's Entomological Report, Department of Agriculture, U.S., 1880, which says, "This is a very troublesome pest of the *Camellia* in the conservatories of this department. It also infests a palm (*Kentia balmoriana*) and *Cycus revoluta*."

Mr. Maskell reported it in 1891 (Transactions of the New Zealand Institute) as occurring on palms in Australia, and in the same journal in the following year received specimens from Mr. Koebele on palms and *Leptospermum* in New South Wales.

This season it is very plentiful upon camellias.

It is a very small rusty-brown in colour, and elongate in form. On close examination with a lens, it will be seen that there is a central ridge, lighter, reddish-yellow in most of the scales, while the edges sloping down are wrinkled. I have not found it upon any other plant.

Planchonia (*asterolecanium*) *quercicola*, Bouche.

Signoret states that this coccid was first noticed upon the oaks near Paris in 1836. It has not been noticed as a pest of any importance since then until it turned up in New Zealand in 1895.

Maskell (Trans. New Zealand Institute, 1896) says he received some twigs of oak from Nelson, New Zealand, thickly covered with many thousands of coccids. Mr. Kingsley, who forwarded the specimens, said "that the owner had noticed the blight about fourteen years ago," but it did not appear to damage the trees very much.

Last year the Director of the Botanic Gardens sent me a number of twigs from the oaks growing in the Outer Domain, upon which the leaves were withered at the tips, and the shoots in a dying condition, from the immense number of scales covering them. Shortly afterwards I examined the oaks in the Botanic Gardens, and found that the tips of every twig was surmounted with four or five dead leaves, giving them a very curious appearance The twigs just at the tips, and for a few inches down, were covered with the bright yellow scales, which, though scattered down the branchlets, did not appear to extend for several feet to the main branches.

This is a small, bright-yellow coccid, clinging very close, and sometimes forming a slight depression in the bark. It is circular in shape, convex in form, with a light-brown mark in the centre.

The Rose Scale (*Diaspis rosæ*), Sandberg, 1874.

This is a very common scale upon rose bushes in all the gardens about Sydney, but I have not found it in the Botanic Gardens.

It has a world-wide range, and is as common in England as here, but, unless very plentiful, does not seem to affect the plant's growth very much.

The scales are almost pure white, except the dark spot in the centre, rounded in form, and about a line in diameter, and when adult are easily detached from the plant.

Most of the scales mentioned may be destroyed with the resin and soda spray frequently referred to in this *Gazette*. Next month, however, I shall give some special notes on the treatment for scale insects.

Magpies (Black and Gray).

Dr. JAMES NORTON.

The genus *Strepera*, placed by Gould in the family of *Laniidæ*, or Shrikes, is represented in this Colony by *S. graculina*, whose habitat extends from Queensland through New South Wales, Tasmania, Victoria, South Australia, and even to Lord Howe Island; and *S. cuneicaudata*, whose habitat appears to be as extensive as that of the black species; Tasmania being the principal habitat of *S. fuliginosa* and *S. arguta*.

The name *Strepera* is derived from the Greek *streperos*, noisy, and, out of the ten synonyms of *S. graculina* given by Gould, no less than nine imply that the bird is a noisy fellow. To these synonyms four more might have been added, for the bird is also known as the Black Magpie, the Mountain Magpie, the Swamp Magpie, and the Port Macquarie Magpie; so, like many other thieves, he is abundantly supplied with *aliases*.

He is a handsome bird, nearly as large as the common crow, his colour being a fine bluish black, and his wings and tail barred with white, which, however, is not noticed except during flight. Some of the tail feathers are not unlike those of the Huia (*Heteralocka acutirostris*), which used to be so much prized and worn as ornaments by the Maoris.

The *Streperas* are generally classed among insectivorous birds, being therefore, presumably, friends of the fruit-grower; and no doubt they do eat a great many insects when they can get nothing more to their taste; but, about Springwood at all events, they are more destructive to fruit than all the other birds put together, being wholesale devourers of apples, pears, peaches, plums, quinces, figs, grapes, and every other kind of fruit, including even unripe date-plums, which one would have thought sufficiently astringent to disgust any bird; and they are terribly destructive to maize, the sheaths of which, covering the young cob, they strip back to enable them to pick off the sweet milky grains just as they are ripening.

They may be driven off by shooting, but soon return if not continually watched. They are particularly destructive to grapes, which they appear to swallow whole, and, notwithstanding the protection of nets, they manage to get at the fruit by searching carefully for any small opening which may be accidentally left, and even sometimes cut their way through the net itself. If the bunches be bagged they insert their long, powerful beaks through any small opening, which may be thereby enlarged, and pick off the protected berries, in doing which they frequently manage to untie the fastenings, so that the bags fall off, and then the bunches are at their mercy. I have also known them to tear their way through the bag if not made of stout material, and then, of course, devour every berry at their leisure.

Large fruit is generally cut to pieces and devoured as it grows, but is sometimes carried off, after the manner of the common crow, to a neighbouring tree, probably impaled on the bird's beak if too large to carry in the ordinary way.

It seems strange that the Satin-bird (*Ptiloncrynchus violaceus*), the Oriole (*Mimeta viridis*), and other fruit-eating birds should often accompany the *Streperas* in their marauding expeditions, arriving and departing with them, and even imitating their notes. It is more singular than other large birds of different habits, such as the Laughing-jackass (*Dacelo gigas*) and the Australian Magpie (*Gymnorhina tibicen*), should also consort with them, apparently on very friendly terms; but it is still more singular that the flocks should often be accompanied by the Sparrow-hawk (*Accipiter cirrhocephalus*) and the Brown Hawk (*Hieracidea orientalis*), both of which frequently attack them while perched in trees, and sometimes while flying, although the hawks, especially the former, are smaller than the magpies. These attacks seem to be made for the mere fun of the thing, but the magpies take them in real earnest, and fly off shrieking in terror and dodging the hawks, which, however, never seem actually to strike them.

Gould was mistaken in thinking that the *Streperas* were not actually gregarious, and only went about in small flocks consisting of the parents and their young. When they first arrive at Springwood in January (in this year they arrived in February), after the breeding season they suddenly appear in a flock comprising some hundreds, and then, after allotting a certain number to that district, the rest pass on to some other place, appearing in this way to apportion the country systematically among the whole body of invaders. The Springwood section usually arrives at my garden from their sleeping place in the early morning, making a great noise and perching in the large trees, where the birds hop from branch to branch till they reach the top, and then, having seen that the coast is clear, they make a descent upon the fruit, sometimes in such numbers that five have been killed at one shot. No fruit is safe from them, unless someone is employed shooting all day long, or unless the orchard is entirely covered in by wire netting. Although on their first appearance it is not difficult to approach them, they soon become exceedingly wary, but great numbers have sometimes been destroyed in the neighbourhood, by poisoning fruit, or sometimes (as I have been informed), a bullock's head, with strychnine; and I should think they might be taken in an ordinary wire fish-trap baited with fruit.

In proof of the necessity for exercising extreme caution in the use of strychnine, I may here state that, late in the past fruit season, a little of this poison was inserted into the last of the date-plums, and that three or four birds were afterwards found dead and were devoured by a number of house cats, which had gone wild and become a great nuisance, the consequence of which was that the whole of the cats disappeared.

The Black Magpies have no song, properly so called, but they have well earned the reputation of being noisy, for they almost constantly utter a loud rolling and not unmusical note, often again a noise like the creaking of an ungreased wheel, sometimes a jeering kind of cry, and when squabbling among themselves, or alarmed by the attack of a hawk, a kind of shriek, and they are rarely quiet except in the case of a few straggling sneaks, which remain behind when the main flock has been hunted off, restraining their inclination to cry out in order to avoid detection.

The gray magpie has just the same habits as the black, with which he associates freely, but he is somewhat larger and handsomer, being of a slaty-gray colour. He is much rarer at Springwood than the black, but is numerous farther inland and the black is there rarer.

It is only fair to say that though the strepera is so terribly destructive in my neighbourhood, yet in other places he does little or no mischief, probably confining himself to an insectivorous diet, and possibly adding the wild fruits

which he eats here when the garden fruit is gone, such as lilli-pillies, white cedar berries, wild grapes, *elæocarpus*, and mistletoe, and that introduced nuisance, *Phytolacca*.

As fruit becomes scarce the flocks decrease in number, but late in the winter the birds have been seen to congregate in a very large flock preparatory to migrating further inland, and then nothing more is seen of them till their return next summer, generally after the apricot and other early fruit crops are over, but in time for everything else; a very few, however, remain through the winter and breed here.

On the appearance of the magpies last summer, which took place a month later than usual, they at first scarcely touched the fruit, and, for some unaccountable reason, the small birds were equally abstinent; but to counterbalance this, the common crow appeared in larger numbers than usual, and carried off quantities of fine Coe's Golden-drop plums, peaches, &c., and devoured them in the neighbouring large gum trees, under which the ground is still strewn with the stones of the stolen fruit.

I am told by a neighbouring fruit-grower that the crows are also very destructive to mandarin oranges.

The Destruction of Rabbits by means of the Microbes of Chicken-Cholera.

The following report of experiments conducted in Queensland by Mr. C. J. Pound, F.R.M.S., Government Bacteriologist, in the destruction of rabbits by means of the microbes of chicken-cholera, was recently laid before the Parliament of Queensland, and is reproduced by permission of Mr. Pound.

The Discovery of Chicken-Cholera in Australia.

On the 25th July, 1895, Mr. Pound forwarded to the Chief Inspector of Stock, Brisbane, the following report:—

I have the honor to report on an extremely interesting and important discovery, namely, the existence in Brisbane of a disease among poultry, technically spoken of as *Septicæmia hæmorrhagica*, but more commonly known in European countries as chicken-cholera.

The micro-organism, which is undoubtedly the sole exciting cause of this disease, was the one which M. Pasteur proposed to introduce into New South Wales for the purpose of exterminating the rabbits.

During the sittings of the Royal Commission of Inquiry into Schemes for Extermination of Rabbits in Australasia, a very important question arose, namely, does chicken-cholera in any form exist in the Australian colonies? Whereupon Dr. Katz, the chief expert to the Commission, was requested to prosecute inquiries and report on the results of his investigations as to the cause of death of a number of fowls submitted to him for examination from various parts of New South Wales, Victoria, Tasmania, and New Zealand, where some epidemic, which was supposed to be analogous to chicken-cholera, had carried off hundreds of fowls. Each specimen was accompanied by a descriptive and apparently faithful report on the nature of the disease as it appeared on the various poultry-farms.

After having perused these reports and examined some of the fowls from the nine different districts, Dr. Katz reported to the Commission on the results of his investigations, and concluded his report as follows:—

"Thus, in none of the above nine cases could the disorder of which the above fowls died be identified as fowl-cholera; but, in order to form a definite opinion as to whether this infectious disease exists in Australasia or not, further examinations are required and must be continued for some time."

The question, "Does chicken-cholera exist in these colonies?" was, in my opinion, the most important one the Commission had to deal with in reference to M. Pasteur's proposals, and nothing should have been neglected in endeavouring to thoroughly investigate this important matter.

So far as I am aware up to the present, there are no records to be found of anyone having discovered the existence of chicken-cholera in these

colonies. I therefore claim priority in scientifically proving the existence of this historical disease in Australasia; further, I have every reason to believe, from my own practical observations and information received from reliable sources, that it has existed not only in Brisbane, but in other parts of this and the neighbouring colonies for a number of years.

How the Disease in Brisbane came under notice.

On the 20th of last month I received information that a number of ducks and fowls were dying from apparently some form of poisoning. I requested that one of the dead birds should be forwarded to the laboratory for examination. The next day a Muscovy duck was received which had recently died.

Post-mortem Appearances.—Both the liver and spleen were somewhat enlarged and congested. The pericardium or membrane covering the heart contained a quantity of œdematous fluid. The outer surface of the heart was covered with numerous hæmorrhagic patches due to extravasation of blood. The lungs were only slightly congested. A very noticeable feature was the intense inflammation all along the intestines, the blood-vessels having the appearance of being injected, while the contents of the intestines presented a greenish-yellow watery appearance.

Microscopical Examination.—Cover-glass specimens of blood taken from the liver were found to contain numerous minute oval-shaped bacteria lying between the blood-cells, which, when stained with Loffler's alkaline methylene blue appeared morphologically identical with Pasteur's microbes of chicken-cholera. Specimens prepared from the contents of the intestines revealed the presence of extraordinary numbers of the same organism. Inoculations from the blood were made on nutrient sterilised agar-agar, gelatine, and potato and in beef broth, all of which yielded typical cultivations of the chicken-cholera microbe.

Experiments on Rabbits, &c.

Experiment I.—A mere trace of the blood from the spleen of the duck was injected into the subcutaneous tissue of a rabbit and a mouse; both died in about fourteen hours, with all the symptoms peculiar to this disease. On microscopical examination of the blood from various internal organs of both these animals the same bacteria were discovered. Cultures also yielded positive results.

Experiment II.—Blood from rabbit I was injected into a rabbit, a guinea-pig, and a pigeon. In this experiment all the animals died within twenty-four hours of acute septicæmia. Microscopical examination and cultivations on various nutrient media gave positive results.

Experiment III.—A rabbit fed with a little of the blood from rabbit I died in twenty hours with the same characteristic symptoms. Microscopical examination and cultivations also gave positive results.

Experiment IV.—Four rabbits were fed with a broth-culture of the bacteria from the blood of rabbit III; all died within twenty-four hours with symptoms characteristic of infection from chicken-cholera. Microscopical examination and cultivations again gave positive results.

In addition to the above experiments a number of other rabbits and fowls were experimented on, both by feeding and inoculation, the results of which were highly satisfactory in demonstrating the nature of the disease.

All the animals used in the foregoing experiments were well nourished and healthy, having previously been kept under observation for sever months.

Symptoms in Fowls and Rabbits.

Subcutaneous injection of a minute quantity of a virulent culture usually kills chickens within forty-eight hours. Some time before death the fowl falls into a somnolent condition, and, with drooping wings and ruffled feathers, remains standing in one place until it dies. Infection may also occur from the ingestion of food moistened with a culture of the bacillus or soiled with the discharges from the bowels of other infected fowls.

In rabbits death commonly occurs in from sixteen to twenty hours, and is often preceded by convulsions. The temperature is elevated at first, but shortly before death it is reduced below the normal.

A remarkable fact in connection with this disease is that in whatever way the micro-organisms are introduced, either by ingesting or by direct inoculation into the subcutaneous tissues, they always find their way into the general circulation; thus death is really due to true septicæmia or blood-poisoning.

Morphology.—The microbe of chicken-cholera is one of the smallest germs known, rarely exceeding the one twenty thousandth ($\frac{1}{20000}$) of an inch in length and the one forty-two thousandth ($\frac{1}{42000}$) of an inch in diameter; in fact, it not only requires the use of specially-prepared stains and the highest class lenses for its detection, but a certain amount of skill and perseverance in order to understand its morphological characters.

In specimens of blood from an animal dead of *Septicæmia hæmorrhagica* stained with an alkaline solution of methylene blue, the organisms appear, when suitably illuminated under an oil immersion lens, as extremely minute, slightly oval-shaped cells, the poles or extremities staining very deeply, while the central portion remains almost clear.

They are mostly uniform in size, but more rarely some are seen to be very much longer, taking the stain in a more irregular manner.

Biological Characters.—The chicken-cholera organism is non-motile; does not form spores; grows in various culture media at the room temperature, but more rapidly at 100 degrees Fahr., or just above blood heat. It is an ærobic bacterium—that is to say, oxygen is necessary for its development.

Upon gelatine plates after three days' incubation at 70 degrees Fahr., the colonies appear as extremely minute, granular, spherical, white dots, with a more or less irregular outline, and by transmitted light have a yellowish colour; later the central portion of the colonies is of a yellowish-brown colour, and is surrounded by a transparent peripheral zone.

In streak cultures upon the surface of sterilised tubes of nutrient agar-agar, gelatine, or blood serum, the growth is limited to the immediate vicinity of the line of inoculation, and consists of finely granular, semi-transparent colonies, which form a thin greyish-white layer with irregular somewhat thickened margins.

Upon potato no development occurs as a rule at the room temperature, but in the incubator a thin, yellowish, waxy layer is developed in the course of a few days.

Development in bouillon (beef broth) is rapid, and causes a uniform turbidity of the fluid.

Conclusion.

When we consider the extraordinary numbers of different breeds of poultry which have been annually imported into Australia from various European countries where chicken-cholera has been known to exist from time immemorial, and also the numbers of live fowls (for table use) carried

on passenger boats to Australia from different English, American, and continental ports, it appears more than ridiculous to suppose that a bacterial disease like chicken-cholera should have been excluded from our shores up to the present time.

*NOTE ON THE EXISTENCE OF CHICKEN-CHOLERA IN NEW SOUTH WALES.

Since the above report was written I received from R. D. Richards Esq., Violet-street, Bathurst, on the 14th August, 1895, specimens of livers of fowls dead of chicken-cholera, as proved by microscopical examination, cultivation, and inoculation experiments. In a letter which accompanied the specimens Mr. Richards states that the disease, chicken-cholera, has appeared amongst his poultry periodically for the last ten years, each epidemic killing off numbers of young and old birds.

REPORT ON THE ADVISABILITY OF EMPLOYING THE MICROBES OF CHICKEN-CHOLERA IN THE DESTRUCTION OF RABBITS.

On the same date, Mr. Pound submitted a proposal to conduct experiments as follows :—

I have the honor to report on the advisability of carrying out certain experiments in accordance with a resolution moved by the Central Rabbit Board, which was to the effect that a disease known as *Septicæmia hæmorrhagica* be introduced among rabbits within an enclosed area in the Western district of this colony.

Ever since the rabbits have become a pest in Australasia, the principal objection (one upheld by the Intercolonial Rabbit Commission) to introducing a fatal disease such as chicken-cholera among rabbits has been, and is at the present time, the non-existence of such disease in these colonies. Previous to and during the sittings of the Rabbit Commission, in fact up to the present time, no one has actually proved in a scientific manner that chicken-cholera prevails in any part of Australasia, although, as I have stated in the appended report, this disease now exists in Brisbane; moreover, from information which I have gathered from reliable, sources there can be no doubt that this same disease has existed for a number of years among poultry in various parts of Australasia, more especially in populated centres, although not in rabbit-infested districts,

It is my experience, and I believe it is also the opinion of nearly every authority on chicken-cholera, that mankind, horses, cattle, sheep, pigs, and dogs are naturally immune from its influence. This fact was especially dwelt upon by the Rabbit Commission, for it was shown that a horse, a cow, a sheep, a goat, a pig, and a dog did not suffer after many meals containing large doses of broth-cultures of the microbes of chicken-cholera. Further, as a result of their labours, the Commission state that from actual experiments they find that apparently the tendency of native birds to contract chicken-cholera by their association with infected rabbits or feeding upon the carcasses of rabbits dead of this disease is not great.

In view of these statements and the fact that this disease already exists in this colony, I can see nothing to prevent an experiment as suggested by the Central Rabbit Board being conducted on a large scale within an enclosed

* Slip from *Daily Telegraph*, 14 August, 1897.

area in the Western district. In my opinion this is the only satisfactory way of testing the efficacy of chicken-cholera as a means of mitigating the rabbit pest in the infested districts; for I consider that the experiments which were conducted on a small scale and under decidedly unnatural conditions on Rodd Island in 1887 and 1888 were far from satisfactory in proving that the disease could not be communicated or spread freely from one animal to another. Even providing that in our experiments we find that the disease does not spread freely, and that it is necessary before an animal becomes infected to partake of the virus in its food, I consider that the method would be a much easier and a far less expensive one than the present method—viz., the poisoning of rabbits with wheat or pollard soaked in a solution of phosphorus or arsenic; also another point which must be taken into consideration in feeding rabbits with the microbes of chicken-cholera is that they rarely squeal before death, whereas those poisoned with almost any mineral poison invariably squeal as the effects of poisoning become more pronounced. If a number of rabbits which are poisoned at one time cry or squeal out together, a panic ensues among the unpoisoned remaining rabbits, causing them to scatter in all directions.

The Intercolonial Rabbit Commission raised another objection on the use of chicken-cholera as a means of destroying the rabbits—viz., that it has never been known to prevail naturally among them; but to show how unwarranted this objection is, I beg to draw special attention to the extermination of plagues of field-mice in various parts of Greece and Southern Russia by feeding these small rodents with cultures of the bacillus *Tyhhi murium*, producing a disease called mouse-typhoid, which has never been found to prevail naturally among mice.

The micro-organism bacillus *Typhi murium* was accidentally discovered by Loffler in 1889 while experimenting with mice in his laboratory at Greifswald; and whereas another organism, the bacillus of mouse septicæmia, is extremely fatal to white-mice and house-mice, while field-mice are naturally immune, the bacillus *Typhi murium* affects both species.

After carrying out a series of successful experiments, Loffler states that he believes that this bacillus may be used for the destruction of field mice in grain-fields, inasmuch as they invariably die after ingesting food which has been contaminated with it.

Up to the time of these experiments the field-mice in various parts of Greece were a perfect pest, destroying the crops of grain wherever they succeeded in obtaining a footing, thus causing a serious loss to the farmer and the country in general; but on the introduction among the mice of what might be termed a laboratory disease-producing micro-organism (the bacillus *Typhi murium*), the results obtained were nothing short of marvellous, as the mice were readily exterminated.

Therefore it appears perfectly clear that the effects of disseminating the microbe of chicken-cholera among rabbits in Australia would be somewhat analogous to the spreading of the bacillus *Typhi murium* among the field-mice in Greece and Russia, which was attended with satisfactory results.

Although I have stated that the scheme for the destruction of rabbits with the microbes of chicken-cholera is attended with certain advantages, I do not infer that the present method of poisoning should be altogether discarded; for I am of opinion that in order to keep a check on this increasing pest we must employ a combination of schemes, for the conditions of environment may be favourable to one scheme while another will fail.

The results of the experiments which I conducted with the bacteria of chicken-cholera up to the present prove conclusively that this micro-organism

is extremely pathogenic for rabbits—in fact, they are more susceptible to its influence than any other animal. Rabbits fed with an infinitesimal amount of a broth-culture of this bacteria invariably die in from sixteen to twenty hours of acute septicæmia or blood-poisoning.

It has been repeatedly proved by carefully conducted experiments that in the case of chicken-cholera rabbits die apparently as the result of the introduction of a single microbe, which increases with such extraordinary rapidity within the body as to cause death in a few hours; therefore a single tube containing about 8cc. or two tea-spoonfuls of a broth-culture of the microbes contains sufficient micro-organisms to kill thousands of rabbits.

In conclusion, I may mention that at present I am engaged in carrying out a series of experiments with the chicken-cholera microbe in order to arrive at some conclusion as to the best available method of disseminating it among the rabbits.

Report containing Summary of Conclusions arrived at after Experiments at Dilltoppa.

In November, 1893, Mr. Pound submitted to the Honorable the Minister for Lands, Brisbane, a report containing a summary of conclusions arrived at after experiments conducted at Dilltoppa:—

In accordance with your instructions, I have the honor to submit herewith a summary of conclusions arrived at in my report (which is not yet complete) on experiments conducted with the bacteria of chicken-cholera.

These investigations were mainly instituted for the purpose of testing the efficacy and practicability of employing this disease for the destruction of rabbits living under natural conditions in open country, as recommended to the New South Wales Government in the first instance by the late M. Pasteur.

1. Chicken-cholera has been proved to exist naturally among poultry in Queensland and New South Wales.
2. The bacteria of chicken-cholera, when added to the food of a rabbit, produces an extremely virulent form of septicæmia, or blood-poisoning, which invariably results in the death of the animal in from eight to twenty-four hours.
3. Carefully-conducted experiments show that although chicken-cholera is a natural disease of fowls, they are not nearly so susceptible to its influence as rabbits.
4. The disease, if introduced among rabbits living in close community, may, under certain conditions, be of a highly contagious nature.
5. In fowls the disease is characterised by symptoms of acute diarrhœa, while in rabbits this symptom occurs only occasionally.
6. Active bacteria of chicken-cholera are found in the excrement of rabbits suffering from diarrhœa after being fed or inoculated with the same microbes. In exceptional cases, active bacteria are also found in the exudation from the mouth and nostrils of rabbits dead of this disease.
7. It has been definitely proved by accidental and specially-planned experiments that rabbits suffering from acute diarrhœa, as a result of infection with chicken-cholera germs, are capable of communicating and disseminating the disease among healthy rabbits living in close community.

8. The method proposed for distributing the infective material, which may be obtained either from virulent broth-cultures or from the blood of rabbits dead of the disease, among rabbits in open country is practically the same as that at present in use for distributing phosphorus and other poisons.
9. The process of preparing and distributing the infected pollard is not nearly so dangerous as when phosphorus and strychnine are employed, inasmuch that human beings, horses, cattle, sheep, pigs, dogs, and cats are in no way susceptible to chicken-cholera.
10. Pollard infected with chicken-cholera microbes is not nearly so dangerous to wild birds as pollard poisoned with phosphorus.
11. Beyond an occasional case of direct infection through eating infected pollard, the chances of wild birds contracting the disease need not be considered.
12. The conditions under which wild birds live absolutely prevent the disease from becoming contagious or in any way assuming an epidemic form among them.
13. Broth-cultures, inoculated direct from an animal dead of virulent chicken-cholera, hermetically sealed and kept in a cool place, will retain their vitality and virulent properties for over twelve months.
14. The bacteria of chicken-cholera, mixed with pollard in the form of pellets (½-inch square) lose their virulence after being exposed to sunlight for twenty-four hours.
15. The bacteria of chicken-cholera, mixed with pollard in the form of pellets (½-inch square) lose their virulence after three days' desiccation in the dark.
16. The bacteria of chicken-cholera, if cultivated artificially for twelve months through twenty successive generations, will become so attenuated as to scarcely produce even a mild form of disease in a young, susceptible animal.
17. The cultivation of the virulent microbes, either in bottles of sterilised broth or in the bodies of healthy rabbits, the mixing of the same with pollard, water, or other agent, and its distribution, may be carried out by any person, even if unacquainted with the rudimentary principles of bacteriology.
18. The material and appliances required for the cultivation of the bacteria of chicken-cholera may be obtained (with few exceptions) on almost all cattle and sheep stations.
19. The practical utility of employing chicken-cholera as a means of destroying rabbits on a large scale in thickly-infested country has been fully demonstrated by the experiments conducted under natural conditions at Dilltoppa.
20. It is only fair to state that this method, like phosphorus poisoning, can only be carried out in a satisfactory manner during dry seasons, when the natural food of rabbits is scarce.

Conclusion.

The evidence which has been brought forward by the somewhat exhaustive series of carefully-conducted experiments, which prove beyond all doubt that the disease known as chicken-cholera is contagious when introduced among rabbits living under natural conditions, is in my opinion of such a highly satisfactory character, and so far conclusive, as to warrant the Government of this or any other Colony granting permission to pastoralists and others who suffer directly from the depredations of rabbits, to utilise this scheme of rabbit destruction.

Report on Experiments with the Microbes of Chicken-Cholera, with special reference to the Destruction of Rabbits.

SECTION I.

Experiments with the Microbes of Chicken-Cholera.

These investigations were mainly instituted for the purpose of testing the efficacy of the late M. Pasteur's method of destroying rabbits in thickly-infested districts with the microbes of chicken-cholera.

The results of the contagion experiments carried out on a large scale under natural conditions in open country have more than realised my expectations, and I feel confident that with careful manipulations during the process of preparing and inoculating the artificial culture media and the judicious application of the infected material, even in unskilled hands, that success is certain to be obtained.

That the process can be conducted by almost any person of ordinary intelligence possessing a little general tact is beyond dispute. For instance, my assistant at Dilltoppa, who had previously spent a number of years on a sheep station in the Central district, had not the slightest conception of the meaning of the word "bacteria," or that the germs of any disease could be cultivated artificially outside the animal body; nevertheless, after a few hours' instruction, and without reading any literature on the subject, he is at the present time perfectly capable of carrying out the whole process of destroying rabbits by means of chicken-cholera germs, providing, of course, that I keep him supplied every month with a virulent culture of the microbes in an agar-agar tube, in order that he may be certain he is dealing with a standardised virulent material.

It will be necessary for any person who intends to adopt this method of rabbit destruction to be supplied from the laboratory periodically with fresh virulent cultures of the organism, otherwise, if the first culture received is allowed to be carried on through successive generations by inoculating from bottle to bottle ot broth, difficulties are almost certain to arise by reason of contamination with foreign organisms, which will grow so rapidly as to crowd out the bacteria of chicken-cholera and produce a cultivation which will be quite innocuous even if injected into a rabbit.

There is one very special and striking feature about the bacteria of chicken-cholera—viz., no matter how virulent they are for rabbits, they may be injected into and taken internally by human beings, horses, cattle, sheep, pigs, or in fact almost any domesticated or wild animals (excluding birds and rabbits), without producing the slightest harm or inconvenience. This fact alone speaks for itself, for when we consider that in order to make the process practical and cheap, unskilled labour will be required, it will be found in some respect, and under special conditions, to be a more acceptable method than that of destroying rabbits with phosphorised pollard, which requires the utmost care in its preparation.

Method of cultivating the Chicken-Cholera Microbes.

The bacteria of chicken-cholera are not particularly dainty. The nutrient media for cultivating them may be prepared from the flesh of almost any kind of animal. In my experiments I have used the flesh of bullocks, sheep, goats, horses, rabbits, and various kinds of wild and domesticated birds (crows and hawks, fowls and ducks).

In the various text-books and manuals of bacteriology, it is stated that, in order to ensure success in the preparation of nutrient media, carefully sterilise a number of glass flasks and funnels; and then take a known quantity of finely-chopped lean meat and mix with a definite quantity of distilled water; allow the mixture to stand for twelve hours; afterwards, separate the liquid portion by squeezing through a cheese-cloth; add peptone and salt in definite quantities, and carefully boil in a flask for an hour and a-half in a Koch's steam steriliser; render faintly alkaline with carbonate of sodium; wait until the liquid is cool, and carefully filter through Swedish filter-paper into well-sterilised flasks or test-tubes, plugged with cotton-wool; and finally sterilise for fifteen minutes on three successive days. Although for our purpose this elaborate mode of procedure is quite unnecessary, yet we cannot altogether depart from the laws laid down for the pure cultivation of a given species of bacteria; but at the same time we must employ some method requiring only a minimum amount of skill, labour, and appliances which will give the maximum amount of satisfactory and practical results.

Most persons who have either been through a complete bacteriological laboratory or read any of the numerous text-books and manuals dealing with the pure cultivation of micro-organisms, and noted all the various glass flasks, tubes, funnels, &c, and the different apparatus utilised for sterilising these vessels, together with the somewhat elaborate incubators, with their ingenious gas-fittings and delicate ether-mercurial regulators for keeping an even and constant temperature, in order that the cultures may be maintained at the temperature of the body for a definite period, will at once say that to cultivate the bacteria of chicken-cholera, to be used as a rabbit-poison on a large scale, is almost an impossibility.

The method of preparing the broth-culture or nutrient medium at the Dilltoppa, Koopa, and Kooliatta camps is as follows:—Take about 10 lb. of meat (beef or mutton), cut it up into small pieces about 1 inch square, and transfer to an ordinary clean kerosene tin, with 2 gallons of water (rain-water is preferable, but the water at Dilltoppa was quite opaque, almost the colour of coffee), and three tablespoonfuls of common salt. The mixture is allowed to boil (stirring occasionally) for three or four hours. At this stage, if a little of the broth be placed on a small piece of blue litmus-paper it will be found to turn it distinctly red, showing that the material is acid. Here I wish to point out that the microbes of chicken-cholera will not grow in an acid media, the best and most favourable medium being one which is either neutral or just faintly alkaline. We therefore carefully add a saturated solution of sodium carbonate (stirring to thoroughly mix) until the red litmus-paper turns slightly blue, and the blue paper slightly red, which shows that the broth is fairly neutral. Our next step is to separate the solid particles from the fluid by gently squeezing through a piece of calico or cheese-cloth; the fluid portion in this case is not so clear as if it were passed through filter-paper, which is not absolutely necessary for the purpose. It is then decanted into our culture-vessels—*i.e.*, the Worcester or tomato sauce bottles, filling each with a funnel within 1½ inches of the neck.

If by accident any of the broth should have touched the inside of the bottle where the cotton-wool plug fits, it must be immediately wiped off with a clean cloth.

Each bottle is then plugged with a stopper of cotton-wool made as near as possible of the same consistency throughout.

Having gone so far, we have to render the contents of each bottle absolutely germ-free. The process is technically spoken of as sterilisation, for, unless

all the existing germs in the broth are destroyed, we cannot expect to have a pure cultivation of the microbes of chicken-cholera, as the extraneous organisms will often grow at such a rapid rate that they simply crowd out the organisms which are intended to be cultivated.

The process of sterilising the broth is carried out as follows:—Immediately the bottles are charged with broth and plugged with cotton-wool, they are placed in a kerosene tin containing sufficient water to come half-way up the bottle. The tin is then placed on the fire, and the water allowed to boil for about twenty minutes to half an hour. A cover* of some description should be placed over the tin to keep in the steam, which sterilises the plug also. The tin is then transferred from the fire, and, without removing the bottles or the cover, set aside to cool. The process of sterilising is repeated again on the two days following; then the bottles of broth, when cool, are ready to be inoculated with the virulent bacteria of chicken-cholera. This is accomplished in the following manner:—The culture tube,† with the filmy growth on the surface of the agar-agar jelly, is taken in the left hand with the mouth downwards. The platinum needle is sterilised by heating it in the flame of a spirit-lamp to a white heat, and after cooling is introduced into the tube, and charged with a mere trace of the filmy growth from the surface of the agar-agar jelly, and at once introduced into a bottle of broth, carefully rubbing the growth against the inside of the bottle; then withdraw the needle and replace the cotton-wool plug. The process of inoculating the bottles of broth should be carried out expeditiously and without interruption, in a room free from dust and wind, and special care must be taken that that part of the cotton-wool plug which comes in contact with the bottle has not been allowed to touch the fingers, nor laid on the table or bench; otherwise fallacies are certain to arise. The plugs of the bottles and tubes should always be held between the tips of the fingers during the process of inoculation. After the plugs have been replaced in the bottles, the outer portion should be burned, in order to destroy any organisms that may have been introduced from the fingers.

The inoculated broth-cultures are now placed in an incubator‡, and maintained at a temperature of about 100 degrees Fahr., which is slightly above blood heat in the human subject.

Experience has shown at the Dilltoppa camp that it is quite unnecessary to place the bottles of inoculated broth in the incubator, as the outside

* At Dilltoppa camp, where we had to contend with many difficulties, two old shirts tied over a piece of tin were brought into requisition as a cover, thus preventing the escape of steam.

† Each agar-agar culture tube contains a sufficient quantity of bacterial growth to inoculate 100 bottles of broth; therefore it will at once be seen that only an infinitesimal amount of material is required for each bottle.

‡ The incubator which was used at Dilltoppa for accelerating the growth of the bacteria of chicken-cholera during the cold weather consisted of a square copper box with double walls and a hinged door in front. On the top front right-hand corner a small piece of copper tubing is fixed into a hole in the outer wall to be used for filling the interspace with water. In order to ascertain the temperature of the interior of the incubator when working, a long tube thermometer is fixed in a piece of cork inserted in a small piece of copper tubing which passes through the top of the incubator and is secured to both walls. The heating apparatus consists of a very small kerosene lamp with half-inch wick placed directly underneath the incubator, which is elevated upon an iron stand, or, what is equally satisfactory, several ordinary bricks. For convenience and to prevent the draught from blowing out the light, both lamp and incubator are placed inside a large packing-case turned sideways. The temperature required for cultivating the bacteria of chicken-cholera should not be below 75 degrees Fahr. or above 104 degrees Fahr. In order to obtain the best results, however, the temperature should be maintained as nearly as possible at 100 degrees Fahr.

temperature during the summer months in these Western districts is sufficiently high to incubate almost any species of bacteria during the day-time, and if kept in a warm room at night, satisfactory results should accrue.

METHOD OF EMPLOYING THE BROTH-CULTURES OF CHICKEN-CHOLERA BACTERIA.

Considering that the bacteria of chicken-cholera, although very fatal to rabbits and poultry, are absolutely innocuous or harmless to other domesticated animals, such as horses, cattle, sheep, goats, pigs, dogs, and cats, and also to human beings (whether taken internally or injected subcutaneously), there is absolutely no danger whatever to the person who carries out the operation of mixing the virulent broth-cultures with the pollard (even if he has cuts or sores on the hands, he need trouble no more than if he were mixing pollard with distilled water). The fact that on several occasions, in the presence of visitors at Dilltoppa camp, I ate pieces of bread soaked in a broth-culture of virulent chicken-cholera microbes is alone sufficient guarantee of the harmlessness of this particular species of micro-organism.

By experiments it has been shown that half a pint of broth-culture contains enough material to directly infect with certainty at least 1,000 rabbits, which means that one bottle of broth-culture must be added to sufficient pollard and water to make 1,000 pellets, half-inch square, of the consistency of dough; therefore, to be well within the limit, a brew of 2 gallons of broth should contain sufficient infective material, added to pollard, to directly destroy at least 20,000 rabbits irrespective of those that contract the disease by other means, viz.:—Infection from the excreta of animals suffering from diarrhœa during the progress of the disease, and by licking the sero-sanguineous material which sometimes exudes from the nostrils and mouth of animals recently dead of chicken-cholera.

As mentioned in another part of this report, the distribution of the pollard should be carried out just before or after sundown.

In carrying out this scheme of rabbit destruction the fact must not be overlooked, as in the case of phosphorised pollard, that some of the infected pellets will be taken by certain species of birds, such as crows, pigeons, quails, and parrots, also that some rabbits will take considerably more than their share of the infected pollard. Hence it necessarily follows that the death-rate will be considerably less in some instances than would otherwise be anticipated after distributing pollard infected with chicken-cholera.

It is ridiculous to suppose that a rabbit, living under natural conditions, will only partake of the necessary lethal dose of infected pollard when such pollard is distributed in a systematic manner over a certain sandhill. On numerous occasions after laying infected pollard I have found dead rabbits with their stomachs literally packed with pollard; in fact, in the stomachs of several rabbits that I have examined I found sufficient pollard to cause the death of several hundred other rabbits.

When I left Brisbane for Dilltoppa I was under the impression that the method of employing the microbes of chicken-cholera for the destruction of rabbits could be carried out in a more expeditious, cheaper, and less troublesome manner than that of continually cultivating the micro-organisms in bottles of beef or mutton broth.

The plan I proposed to adopt was as follows:—After the first distribution of infected pollard, collect the livers of all dead rabbits, and mash them up in the water to be mixed with the pollard for a second distribution, and so on in such a way as to make use of all dead rabbits as fresh infective or poisonous agents.

I am extremely sorry to say that in all the rabbit-infested country that I have visited this method, which is a decidedly practical one, could not be put into operation owing to the prevalence of remarkable numbers of hawks and crows, which are ever ready to pounce upon and devour every rabbit that shows signs of sickness.

SECTION II.

Experiments on Healthy Rabbits placed in Hutches in which specially-infected Rabbits had died of Chicken-Cholera.

CAGE A.—EXPERIMENT I.

16th September, 1895.—Two rabbits specially fed with a virulent broth-culture of chicken-cholera died in twenty-one and twenty-six hours respectively (one had slight diarrhœa). * P.M.: Positive.

18th September.—In this cage, which was not cleaned out, four other rabbits were placed.—Result: Two became infected and died, while the other two remained alive.

CAGE B.—EXPERIMENT II.

26th September.—One rabbit fed with a virulent broth-culture of chicken-cholera died with a slight diarrhœa in eighteen hours. P.M.: Positive.

28th September.—Without removing the above dead rabbit, two healthy ones were placed in with it for one day only, and then removed to a new cage with several other rabbits. Result: One died in three days. P.M.: Positive. The other remained alive.

CAGE B.—EXPERIMENT III.

2nd October.—Two healthy rabbits were placed in this cage, which had not been cleaned out since the last experiment on 26th September. Both removed after three days to a new cage, when one died shortly afterwards of chicken-cholera. The other one remained alive.

CAGE C.—EXPERIMENT IV.

4th November.—Two rabbits fed with virulent blood of a rabbit that died of chicken-cholera were placed in a new cage with two healthy rabbits. Result: The two infected ones died within twenty hours. P.M.: Positive. One of the uninfected one died in forty-eight hours. P.M.: Positive. The other remained alive.

CAGE D.—EXPERIMENT V.

17th January, 1896.—One small rabbit inoculated with a virulent culture of chicken-cholera, and two small healthy animals placed in the same cage. Result: The infected rabbit died in twenty-two hours with acute diarrhœa. P.M.: Positive. The two uninfected one died in forty and sixty-three hours respectively of chicken-cholera.

CAGE E.—EXPERIMENT VI.

26th September, 1895.—One rabbit fed with liver of fowl dead of chicken-cholera. Result: Died in eighteen hours. P.M.: Positive.

28th September.—The dead carcass, which had a slight sanguineous exudation from the nose, was placed in a fresh cage with four healthy rabbits for twelve hours and then removed. Result: One died of chicken-cholera in two days, while the other three remained alive.

In addition to the above specially-planned experiments, rabbits which had been kept in cages used some time previous for experimental purposes have been found dead of chicken-cholera.

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* *Post-mortem* examination.

The following are the recorded cases, all of which on microscopical examination were found to have died of chicken-cholera:—

Date.	Number and Size of Rabbits.	Remarks.	Date.	Number and Size of Rabbits.	Remarks.
1895.			1896.		
16 Sept. ..	1 full grown		18 June...	1 full grown	Acute diarrhœa.
26 ,, ..	2 young ...	1 slight diarrhœa.	25 Aug....	1 ,,	
2 Oct. ...	2 full grown		5 Oct. ...	3 ,,	
	3 young ...		13 ,, ...	1 ,,	
20 Nov. ...	1 full grown		19 Nov...	1 ,,	
15 Dec. ...	1 young ...	Slight diarrhœa.	23 ,, ...	2 young.	

Experiments with Chicken-cholera carried out on a large scale at Dilltoppa.

Enclosure D.

25th August, 1896.—On this date an enclosure was made by fencing with 200 yards of rabbit-netting against the inner side of the fence of Enclosure C. This paddock enclosed a large warren, containing in all fourteen burrows, and, as far as could be ascertained by frequent evening visits after sundown, about twenty rabbits.

5th September.—Fifty healthy and well-nourished rabbits recently brought from Koopa sandhills (some 30 miles distant) were introduced.

9th September.—By this time the rabbits from Koopa had become established and settled down to their new quarters.

9th September.—At 6 p.m. in the evening, nine pellets (½-inch square) of pollard infected with a virulent broth-culture of chicken-cholera were laid within the enclosure in the following manner:—Three under salt-bushes, two under hop-bushes, and four at the entrance of the burrows.

9th September.—Control: Three control rabbits, kept in a cage at the camp, fed with some of the infected pollard as used in the enclosure. Result: All died of chicken-cholera in twenty-three, twenty-four, and thirty-one hours respectively.

10th September.—On close examination it was found that two of the pellets had only just been nibbled at, although other natural food was getting scarce.

12th September.—Pellets all taken except one under one of the salt-bushes and one near a burrow. One dead rabbit found near a burrow. P.M. examination: Died of chicken-cholera. Dingo tracks very numerous.

13th September.—No dead rabbits found; but fresh dingo tracks still conspicuous.

16th September.—Live rabbits within the enclosure appear to be getting less.

20th September.—Very few live rabbits to be seen. The slight shower of rain on the previous evening showed the dingo tracks up very prominently, which were numerous around and even in some of the burrows.

21st September.—Decided on digging out the warren with the help of the boundary-rider and my assistant.

21st September.—After fully ten hours' hard work shifting what might be termed quicksand, we came to the ends of the burrows, and succeeded in finding only one dead rabbit and capturing eleven live ones. P.M. and microscopical examination proved that death was due to chicken-cholera.

The eleven live rabbits, which were very strong and in excellent condition, were removed to a large cage at the camp.

As to what became of the remaining rabbits that belonged naturally to the enclosure and those that were introduced, I feel confident that whether or not they died of chicken-cholera, they must have been taken by the native dogs. From our knowledge of the disease, the way in which the fatal symptoms suddenly appear, and the fact that rabbits, in the majority of cases in our experience, suffering from the disease, die outside their burrows, we must infer that a large number of the missing ones had died from chicken-cholera, but as soon as dead were taken by native dogs, and a few, possibly, by hawks and crows.

21st September.—From this date the native dogs became a source of annoyance, and greatly marred the experimental operations. Every night they visited the various enclosures, and also our camp, and never failed, if opportunity offered, taking away any dead rabbits.

It was therefore deemed advisable not to try any further experiments on similar lines on so small a scale away from the camp, at which place a fairly constant lookout could be kept during the night. Moreover, all such enclosures at the camp we decided to cover over with netting supported by strong saplings.

Experiments in Large Enclosure (D.E.) to test Contagion.

Enclosures D and E were converted into one paddock by removing the dividing fence.

4th October.—Thirty healthy and strong rabbits, including the eleven originally dug out of the warren in Enclosure D on September, were placed in this paddock.

5th October.—Six rabbits specially fed with virulent chicken-cholera microbes were also turned loose. Control: Three control rabbits were also fed at the camp with some of the same infected material. Result: All three died in twenty-one, twenty-six, and forty-two hours respectively. P.M. in each case positive.

Result of Paddock Experiment.—8th to 14th October.—Specimens were procured from twenty rabbits found dead. Seventeen of these were found to have died from chicken-cholera infection.

15th October.—On digging out the burrows, only three live rabbits and the bodies of eight dead ones were found—the latter in various stages of decomposition—and by experiment it was found that two of this number had died of chicken-cholera infection. The remaining six were in such a high state of putrefaction that it was impossible to prove whether or not they had died from chicken-cholera unless the use of special plate-culture apparatus could be obtained, which in these parts was out of the question. Although a searching investigation was made throughout the enclosure, no trace could be found of the remaining five rabbits. They may have been taken by the dingoes, or they may have got over the fence.

Remarks.—9th October.—One dead rabbit was round hanging across the branches of a hop-bush, about 4 feet above the level of the ground. On *post-mortem* examination the contents of the stomach were found to contain portions of undigested hop-bush bark, and from the appearance of the branches on which the rabbit was found it was evident that it had died of chicken-cholera poisoning while in the act of taking a meal in this peculiar position. The result of this experiment is highly satisfactory in proving that the disease is readily communicated in some way from the infected to healthy rabbits even in a large enclosure where the numbers are few.

RESULT of Experiment in Large Enclosure (D.E.)

Date.	Number of Rabbits found dead.	Deaths due to Chicken-cholera.	Deaths not proven.	Remarks.
8 October ...	5	4	1	2 diarrhœa.
9 ,, ...	1	1	...	Found dead hanging in hop-bush 4 feet from the ground.
10 ,, ...	7	6	1	1 slight diarrhœa.
11 ,, ...	2	2	...	
12 ,, ...	2	1	1	
14 ,, ...	3	3	...	1 diarrhœa.
15 ,, ...	8	2	6	All found in burrows.
Total ...	28	19	9	

EXPERIMENT TO TEST THE TRANSMISSIBILITY OF CHICKEN-CHOLERA AMONG RABBITS.

Enclosure H.

2nd October.—Twenty-nine healthy rabbits from Koopa sandhills were placed in Enclosure H, with three specially-infected rabbits (ear-marked).

Date.	Number of Deaths.	Cause of Death.	Remarks.	Date.	Number of Deaths.	Cause of Death.	Remarks.
1896.				1896.			
3 Oct. ..	4	Accidental					
4 ,, ..	1	,,		12 Oct.	1	Chicken-cholera.	Ear-marked.
4 ,, ..	4	Chicken-cholera.	1 had acute diarrhœa.	13 ,,	1	,,	,,
				13 ,,	1	,,	
4 ,, ..	1	,,	Ear-marked.	14 ,,	1	,,	
5 ,, ..	2	,,	1 had slight diarrhœa.	15 ,,	1	,,	Had slight diarrhœa.
6 ,, ..	1	,,	,, ,,	17 ,,	1	,,	,, ,,
7 ,, ..	3	,,		20 ,,	1	,,	Had acute diarrhœa.
8 ,, ..	1	,,					

Notes on this Experiment.—The first ear-marked rabbit that died was left in the enclosure for seven days before being removed. During this period two healthy rabbits were observed to eat portions of the dead rabbit, with the result that both died of chicken-cholera.

In eighteen days (from the 2nd to the 20th October), of the thirty-two rabbits introduced, the three control (ear-marked) or specially-fed rabbits died of chicken-cholera. Of the remaining twenty-nine, five died of accidental causes, and sixteen, or 55·1 per cent., died from chicken-cholera, while eight remained alive.

Enclosure G.

On 1st September, 1896, sixty healthy and well-nourished rabbits were brought from Koopa sandhills and turned loose in Enclosure G. These were well cared for, and supplied with abundance of food. Then, on 14th September, six rabbits, which were specially fed with a virulent broth-culture of chicken-cholera, were turned loose among the healthy ones. The six specially-fed rabbits all died of chicken-cholera within forty hours, while of the sixty not specially fed, nineteen, or 30·6 per cent., died from chicken-cholera within fourteen days. All dead rabbits were removed from the enclosure immediately after death. *Post-mortem* examinations were conducted, and a

microscopical examination made of the blood from the liver and heart of the dead rabbits. Inoculations were also made on nutrient sterilised tubes of agar.

The following table shows the result of the above experiment:—

Number of Rabbits.	Died in—	Remarks.	Number of Rabbits.	Died in—	Remarks.
1 specially fed ...	12 hours	Diarrhœa.	1 not specially fed.	64 hours	
1 " ..	20 "	Slight diarrhœa.	1 "	66 "	
1 " ...	24½ "		1 " "	68 "	
1 " ...	27 "		2 " "	4 days	
1 " ...	38 "		1 " "	6 "	
1 " ...	39 "	Slight diarrhœa.	1 " "	7 "	
			3 " "	8 "	
1 not specially fed	30 "		1 " "	9 "	
1 " "	32 "		1 " "	10 "	
1 " "	42 "		1 " "	14 "	
1 " "	44 "				
1 " "	48 "		25 total number		
1 " "	53 "	Diarrhœa.			

The remainder of the rabbits were kept under observation for another two weeks, during which time no more deaths took place.

Accidental Experiment.

12th September.—Enclosure F, at the camp, was erected with 1½-inch wire netting, sides and roof.

13th September.—A number of healthy rabbits brought from Koopa were placed in the enclosure.

19th September.—Up to this date all the rabbits within the Enclosure F remained perfectly healthy.

A young rabbit (one of the five that escaped from an infected cage) found its way during the night into this enclosure, and died shortly after 6 a.m.; and, as far as can be ascertained, this rabbit was only five hours in the enclosure before death, after which it was removed. On *post-mortem* examination it was discovered that the little rabbit had suffered from acute diarrhœa, and died from chicken-cholera, evidently contracted in the infected cage.

In view of these facts all the remaining healthy rabbits, which were required for a special purpose, were removed to another considerably smaller enclosure. Enclosure G had a spell for two days, but was not cleaned out.

21st September.—127 rabbits, in prime healthy condition, from Koopa sandhills, were turned loose into Enclosure F, in which the small rabbit had died.

Of the 127 healthy rabbits introduced into this enclosure, sixty-seven died with seven days—*i.e.*, between 21st and 28th September. Of this number, only three died from accidental causes, while sixty-four, or just over 50 per cent. of the entire number originally introduced, died from chicken-cholera, as evidenced by the microscopical examination of the blood and the result of the inoculation from the liver on sterilised agar jelly in tubes. On P.M. examination it was found that no less than eight had suffered from acute diarrhœa.

Between 30th September and 17th October eight died from chicken-cholera infection, while none died from other causes. Of this number, one had diarrhœa.

Thus of the 127 rabbits seventy-two died from chicken-cholera within four weeks.

Throughout this experiment it was noticed that occasionally a rabbit became sick, and, although exhibiting all the symptoms peculiar to chicken-cholera infection, it subsequently recovered. Some of these rabbits were carefully marked to see if they possessed some degree of immunity; but in the majority of cases they suffered from another attack, and finally died.

I attribute the epidemic nature of chicken-cholera in this experiment principally to the fact that throughout the period mentioned there was invariably one rabbit suffering more or less from diarrhœa before death. Therefore, as the habits of rabbits in health are in some respects similar to that of the domesticated cat—*i.e.*, when cleaning their head, face, and ears they first of all lick their paws before rubbing them over these parts; they also lick their breasts and under and along the sides in precisely the same manner as a cat does—we can readily understand how a healthy rabbit, while licking itself, can contract the disease by ingesting some of the excrement containing chicken-cholera microbes from another rabbit suffering from diarrhœa.

I am perfectly willing to admit that under natural condition in open country (excepting thickly-populated warrens) the disease can never assume the same virulent proportions, as there are so many other factors and conditions which tend very materially to prevent the spread of the disease.

I consider this experiment, although accidental, one of the most satisfactory and interesting of any that I have ever had an opportunity of watching, for it proves most conclusively that M. Pasteur's scheme was worthy of more consideration than that shown by the Rabbit Commission. Further, it proves that it was more than probable that in the experiment conducted on Madame Pommery's estate, at Rheims, near Paris, when M. Pasteur distributed sufficient infected food for only a limited number of rabbits, the disease must have spread among the remainder by contagion, thus destroying the whole of the rabbits within the enclosed area.

It also tends to show that there must have been some lack of observation in connection with the large experiment conducted by the Experimental Committee of the Rabbit Commission, for in their report it is stated that 100 healthy rabbits were turned loose in an enclosure with twenty-two other rabbits which had been specially fed with chicken-cholera microbes. Naturally a large number—nineteen—of the specially-fed ones died from chicken-cholera, and their bodies were left in the enclosure until the end of the experiment—viz., three weeks—during which time no less than seventy-nine of the 100 not specially fed died; but we are told that of the seventy-nine rabbits which so died not one perished from chicken-cholera. All died apparently in consequence of primary starvation.

I may mention that all our experimental rabbits (unless for a special purpose) were removed immediately after death, consequently there could not be the same opportunity of the disease spreading as there was in the Sydney experiment.

It may be of special interest to know that Pasteur, during his investigations into the etiology of fowl-cholera, pointed out that rabbits recovering from the first attack of the disease, after being inoculated or fed with the microbes of chicken-cholera, were not in any way refractory to subsequent attacks; also that cages used for experimental purposes will retain their infective properties for several weeks.

These observations I have been able to confirm on numerous occasions in Brisbane and at Dilltoppa.

TABLE showing Results of an Accidental Experiment in which a small Rabbit that escaped on 21st September from an Infected Cage was the means of introducing Chicken-cholera Disease among 127 Healthy Rabbits in Enclosure F.

Date.	Number found dead.	Cause of Death.		Symptoms of diarrhœa.	Date.	Number found dead.	Cause of Death.		Symptoms of diarrhœa.
		Accidental.	Chicken-cholera.				Accidental.	Chicken-cholera.	
22 Sept. ...	2	2	...	...	30 Sept. ...	2	...	2	...
23 ,, ...	14	...	14	2	1 Oct. ...	1	...	1	1
24 ,, ...	12	1	11	4	3 ,, ...	2	...	2	...
25 ,, ...	15	...	15	2	10 ,, ...	1	...	1	...
26 ,, ...	4	...	4	...	17 ,, ...	2	...	2	...
27 ,, ...	6	...	6	1					
28 ,, ...	12	...	12	...	Total ...	75	3	72	10
29 ,, ...	2	...	2	...					

SECTION III.

Experiment with Chicken-Cholera on Rabbits living under Natural Conditions in Enclosure C.

This enclosure, which contained about 320 acres, was fenced off with 4-ft. 6-in. wire netting, $1\frac{1}{4}$-inch mesh. The netting was sunk in the ground to a depth of 9 inches.

On close examination of this enclosure it was found that the rabbits were not nearly so numerous as was anticipated; it was therefore decided to introduce a number from Koopa sandhills. Altogether between 600 and 700 rabbits, in lots from thirty to sixty at a time, were obtained from Koopa and other places. Before any experiments were conducted several weeks were allowed to elapse, thus enabling the freshly-caught rabbits to settle down to their new abode, and to make burrows in the sandhill.

From the beginning of September until the end of November only a few slight showers of rain fell, barely sufficient to fill the crab-holes; at one corner of the paddock there was a small waterhole, which dried up within four weeks. Rabbits made visits every evening to this hole to drink. When the water had all disappeared, the rabbits set to work barking the various trees and bushes in search of moisture.

The supply of food for the rabbits was very abundant, viz.:—Lignum-bush, salt-bush, sandalwood, hop-bush, mulga, euphorbia, pigface, and pig-weed, and in some places patches of blue-bush, cotton-bush, and quirra-murrah, all of which are eagerly sought after and much appreciated by the rabbits.

The burrows and warrens were principally confined to the sandhills. A few were found under the lignum-bush, but none on the stony mulga ridge.

From the fact that direct sunlight has a marked deleterious effect upon the micro-organisms contained in the pellets of pollard, it became necessary to distribute the infection material just before or immediately after sun-down.

The experiment in Enclosure C was commenced on 19th September, and observations concluded on 1st December. During this period sixteen quarts of infected pollard were distributed in nine separate lots on the following days:—

Date.	Quantity.	Where Distributed.
19th September, 1896	2 Quarts	Sandhill.
23rd ,, ...	2 ,, ...	,,
25th ,, ...	1 ,, ...	,,
4th October	1 ,, ...	,,
12th ,, ...	2 ,, ...	Lignum.
20th ,, ...	2 ,, ...	Swamp grass.
23rd ,, ...	2 ,, ...	Sandhill.
29th ,, ...	2 ,, ...	,,
3rd November	2 ,, ...	,,
	16	

All the above lots of pollard were infected with both cultures of chicken-cholera, except 12th October lot, which was infected with the blood of a rabbit dead of the disease.

At the time of each distribution, from three to six healthy rabbits were fed at the camp with some of the infected pollard and kept as controls.

TABLE showing the Results of Distributing Infected Pollard in Enclosure C.

Date.	No. of Rabbits found dead.	Result of Examination. Chicken-cholera.	Not proved.	Remarks.
1896.				
*19 Sep.	..	..	..	
20 ,,	3	3	..	1 had slight diarrhœa.
21 ,,	7	6	1	
22 ,,	5	5	..	
*23 ,,	13	11	2	2 had slight diarrhœa.
24 ,,	..	..	..	
*25 ,,	5	2	3	
26 ,,	10	7	3	
27 ,,	3	1	2	
28 ,,	23	16	7	1 had acute and 1 slight diarrhœa.
29 ,,	17	12	5	
30 ,,	..	..	..	
1 Oct.	..	..	..	
2 ,,	9	9	..	3 had slight diarrhœa.
3 ,,	20	13	7	2 had slight diarrhœa.
*4 ,,	11	8	3	
5 ,,	26	22	4	
6 ,,	..	..	..	
7 ,,	14	13	1	
8 ,,	17	17	..	2 had slight diarrhœa.
9 ,,	6	5	1	
10 ,,	..	..	..	
11 ,,	..	..	..	
*12 ,,	..	..	..	
13 ,,	..	..	..	
14 ,,	12	4	8	1 had slight diarrhœa.
15 ,,	7	2	5	
16 ,,	3	1	2	
17 ,,	..	..	..	
11 ,,	3	3	..	
19 ,,	8	3	5	
20 ,,	..	..	..	
21 ,,	5	2	3	
22 ,,	4	..	4	1 had acute diarrhœa.
*23 ,,	..	..	..	
24 ,,	..	..	..	
25 ,,	5	4	1	
26 ,,	2	1	1	

Date.	No. of Rabbits found dead.	Result of Examination. Chicken-cholera.	Not proved.	Remarks.
1896.				
27 Oct.	..	..	..	
28 ,,	7	6	1	
*29 ,,	..	..	..	
30 ,,	3	3	..	
31 ,,	..	..	..	
1 Nov.	..	..	..	
2 ,,	..	..	..	
*3 ,,	..	..	..	
4 ,,	..	..	..	
5 ,,	5	3	2	
6 ,,	..	..	..	
7 ,,	5	5	..	2 with slight symptoms diarrhœa.
8 ,,	1	1	..	
9 ,,	..	..	..	
10 ,,	1	..	1	
11 ,,	..	..	..	
12 ,,	..	..	..	
13 ,,	1	1	..	
14 ,,	..	..	..	
15 ,,	..	..	..	
16 ,,	..	..	..	
17 ,,	..	..	..	
18 ,,	2	1	1	
19 ,,	..	..	..	
20 ,,	..	..	..	
21 ,,	3	2	1	
22 ,,	..	..	..	
23 ,,	..	..	..	
24 ,,	..	..	..	
25 ,,	..	..	..	
26 ,,	..	..	..	
27 ,,	..	..	..	
28 ,,	..	..	..	
29 ,,	..	..	..	
30 ,,	1	1	..	
2 Dec.	1	1	..	
	268	194	74	

* Dates of distribution of infected pollard.

TABLE showing the Results of Experiments controlling the Distribution of Pollard in Enclosure C.

Date.	Rabbits specially fed.	Result.		Remarks.
		Died of Chicken-cholera.	Re-covered.	
1896.				
19 Sept. ...	4	4	...	1 had slight diarrhœa.
23 ,, ...	6	5	1	
25 ,, ...	3	3	...	1 had acute diarrhœa.
4 Oct......	8	6	2	
12 ,, ...	6	6	...	Fed with virulent blood. All died within thirty-six hours. Two had slight diarrhœa.
20 ,, ...	6	4	2	
23 ,, ...	5	3	2	
29 ,, ...	6	5	1	
3 Nov. ...	3	3	...	
Total ...	47	39	8	

One very important point about this experiment is that, although no infected pollard was distributed after 3rd November, rabbits continued to die from the effects of chicken-cholera until the 2nd December, twenty-nine days after.

According to careful experiments, it has been proved that infected pollard loses its virulence when exposed to the direct rays of the sun for only a few hours; therefore, considering that the pellets of pollard were always laid in the open, it is conceivable that the rabbits found dead of chicken-cholera on the 10th, 13th, 18th, 21st, and 30th November, and 2nd December, contracted the disease within the warrens as a result of contamination with excreta of rabbits that suffered from diarrhœa, or through licking the exudation from the noses of dead rabbits.

On the 30th November and the 1st December, after several heavy showers of rain which obliterated all old rabbit-tracks, a careful examination was made of Enclosure C, with the result that traces of only very few rabbits could be found, and these were principally confined to the lignum swamp.

On the two sandhills only four burrows could be found that exhibited signs of being inhabited. All the remaining burrows and warrens were destitute of live rabbits, while the stench that was emitted from the majority of the burrows, and the innumerable swarms of blow-flies, indicated the presence of numbers of dead rabbits in a state of decomposition.

Throughout these experiments not a single instance came under notice of a dead rabbit being found emaciated from the effects of starvation. All were more or less in a prime condition, and invariably the kidneys, abdominal viscera, and muscles above the shoulders were covered with layers of fat.

DISTRIBUTION OF INFECTED POLLARD IN OPEN COUNTRY.

On 21st November I proceeded to Koopa, and just after sundown distributed 4 quarts of pollard (in pellets from $\frac{1}{4}$ inch to $\frac{1}{2}$ inch square) infected with virulent broth-cultures of chicken-cholera over three sandhills, each about 1 mile long by a $\frac{1}{4}$ mile wide.

Each of these sandhills was infested with hundreds of rabbits, while the warrens were very large and numerous near Kooliatta.

It should be specially noted that these sandhills afforded a splendid opportunity for watching the effects of the infected pollard, owing to the absence, on the greater part of the sandhills, of vegetation. In fact, in my opinion, one of these sites should have been selected for the experimental paddocks in place of Dilltoppa.

The smaller vegetation—viz., the salt-bush, cotton-bush, &c.—were entirely eaten out, while the mulga, hop-bush, needle-bush, quirra-murrah, and the cassia trees were all more or less ringbarked to a height in some instances of nearly 6 feet from the ground. Numbers of fairly large trees were quite dead; in fact, quite a weird desert aspect was presented.

On the river frontage there was plenty of lignum-bush, and on the flooded country between the sandhills an abundance of blue-bush, which at this time was in full leaf, as a result of the heavy rains the week previous.

On 22nd November, at 6 p.m., on visiting the sandhills it was found that nearly all the pellets had been taken, but only a few dead rabbits were found.

On 23rd November, early in the morning, crows and hawks were beginning to accumulate around the Kooliatta sandhills; at 4 p.m., on searching the sandhills, numbers of dead rabbits were found in various stages of disintegration, the work of hawks and crows.

24th November.—Before daylight crows could be heard on the sandhills both far and near, and by sunrise were seen in extraordinary numbers in lots of four and five feeding off the bodies of dead and dying rabbits.

25th November.—Crows and hawks plentiful. Remains of dead rabbits lying about in all directions. In the evening, about 5 p.m., a heavy thunderstorm passed over, which obliterated all old tracks of rabbits.

27th November.—In the evening the work of destruction among the rabbits on the various sandhills was most conspicuous. The diminution in the original numbers of live rabbits could be readily detected in various ways, viz.:

(1) The presence of extraordinary numbers of hawks and crows distributed over the different infected sandhills.
(2) The masses of disintegrated remains of dead rabbits.
(3) The apparent remarkable scarcity of live rabbits, even after sundown.
(4) The relatively few fresh tracks on the sandhills and around the burrows.
(5) The swarms of flies around the warrens, and the unpleasant odour emitted from numbers of burrows indicated the presence of dead rabbits within.

28th November.—On this date, owing to the prevailing heavy rains, with the possibility of being isolated by flood-water for a long period, and shortness of rations, it was decided to abandon further observations on these sandhills.

However, the results which have accrued in this instance, by the distribution of only a limited quantity of pollard infected with chicken-cholera microbes among rabbits living in close community in large warrens on sandhills in open country, may be considered so far successful as to warrant its use generally.

Notes on the Distribution of Pollard infected with the Blood of Rabbits dead of Chicken-Cholera.

It not unfrequently occurs that force of circumstances tends to modify the working of some particular experimental scheme in such a way as to minimise the trouble and expense of the process without interfering in any way with the desired results.

During the continuation of the experiments in open country on other sandhills at Koopa, the stock of pure cultivations of chicken-cholera microbes on agar-agar became exhausted. To await for a fresh supply from Brisbane would mean at least three weeks' delay in the experiments; consequently other means had to be taken advantage of, which was effected in the following manner:—

Six healthy rabbits were trapped by the usual method of funnel and cage-yard fixed at the principal entrance of a warren on a sandhill. These rabbits were kept and fed in a special cage at the camp. A mere trace of blood from the remains of an infected rabbit found on one of the experimental sandhills was introduced in the subcutaneous tissue of the back of one of the six healthy rabbits. Within twenty-four hours this rabbit, which we will call No. 1, died of acute septicæmia (chicken-cholera), as evidenced by the *post-mortem* appearances.

After inoculating another rabbit, No. 2, with a little of the blood from No. 1, the heart, lungs, liver, and kidneys of the latter, all of which contained many millions of the virulent microbes, were removed, together with all the blood from the larger vessels, and mashed with sufficient water to mix with half a bushel of pollard to form a fairly stiff paste, which was distributed in the evening in precisely the same manner as infected broth pollard. Immediately after the death of rabbit No. 2 the same process was repeated, and so on until the entire stock of caged rabbits were exhausted.

It was clearly shown, by the number of dead rabbits which were found on the sandhills and among the lignum and blue-bush on the flooded country, that after each distribution they partook very freely of the pollard infected with the septicæmic blood.

Here we have very clearly illustrated how the destruction of rabbits with chicken-cholera may be effected in the most simple and efficacious manner; therefore, in districts where rabbits are very numerous and facilities are afforded for keeping a number of, say, twenty rabbits in a cage, I strongly recommend the adoption of this slightly modified process.

For nothing could be cheaper, more simple, and yet practical, than to, so to speak, grow the infective or poisonous agent in the bodies of live rabbits, for, by so doing, all the trouble and expense of preparing and sterilising nutrient broth, the inoculation of the same, and cultivating the bacteria in an incubator to be maintained at a constant temperature, would be entirely done away with.

Maybe this was Pasteur's original idea of putting his scheme into practical use, although he never made it known publicly; for, in a letter, dated 1st October, 1888, addressed to Mr. Bruce, Chief Inspector of Stock in New South Wales, a free translation of which was published in the *Sydney Morning Herald*, M. Pasteur states that:—

> "With regard to the rabbit plague, I have not confided further to anyone the secret of the use on large scale of the means which I have proposed for the partial or total extermination of these rodents by the adoption of chicken-cholera. It is to the Government of Sydney that I will make it known if there be occasion."

> "How to arrange for the manufacture of the fatal ingredient, how to mix and use at a distance this ingredient with all its properties, that is my secret, about which the Commission is to see and know nothing for the present, and which I will only make known if the prize proposed on the 31st August, 1887, is awarded to me."

SECTION IV.

Experiments with Chicken-Cholera Microbes on different Animals and Birds.

The following experiments were conducted with the view of ascertaining the effect of chicken-cholera on various animals other than rabbits and birds.

The cultures of bacteria used in these experiments were originally derived from the Muscovy duck referred to in a previous report.

Rats.

3rd October, 1895.—Four white and two brown rats were inoculated with a virulent culture of chicken-cholera. Result: All remained alive and well.

Four black and two black and white rats were fed with the liver of a rabbit that died within twenty hours after being inoculated with chicken-cholera microbes. Result: All remained alive and well.

Two white rats were inoculated with a virulent broth-culture of chicken-cholera. Six other rats were fed with the remainder of the broth-culture. Result: Neither the inoculated nor specially-fed ones showed symptoms of sickness.

Mice.

22nd June, 1895.—One black and white tame mouse was inoculated at the root of the tail with a mere trace of blood obtained from the liver of the duck. Result: Died in twenty hours. P.M.: Positive.

Two black and white tame mice fed with liver of the duck. Result: Both remained alive and well.

26th July.—One white mouse inoculated with a broth-culture obtained from a guinea-fowl that died of chicken-cholera. Result: Died in sixteen hours. P.M.: Positive.

Two black and white mice fed with a broth-culture obtained from the same guinea-fowl. Result: Both remained alive and well.

Guinea-Pigs.

26th June.—One guinea-pig inoculated with the blood of a rabbit which died after being inoculated with blood from the Muscovy duck. Result: Died in nineteen and a half hours. P.M.: Positive.

Two guinea-pigs fed with some of the same virulent blood. Result: Both remained alive and well, showing no signs of sickness.

15th October.—One guinea-pig inoculated with a virulent broth-culture. Result: Still alive thirteen days after.

4th November.—Three guinea-pigs fed with the liver of a rabbit that died after being inoculated with chicken-cholera. Result: Remained alive.

5th November.—Two guinea-pigs fed with liver of a rabbit that died after being fed with chicken-cholera. Result: Remained alive.

Other Animals.

26th September.—An opossum, a kangaroo, a kangaroo rat, and a native bear were inoculated with a virulent broth-culture of chicken-cholera. Result: All remained alive, and although they were kept under close observation for over a month no signs of sickness were exhibited.

A kangaroo dog, two greyhounds, two cattle dogs, a collie (sheep) dog, three fox terriers, and several domesticated cats and kittens were frequently fed with virulent broth-cultures and also the flesh of rabbits that had died of chicken-cholera infection, with the result that they never showed any signs of sickness whatever.

PIGEONS (Domesticated).

24th June, 1895.—One pigeon inoculated with a broth-culture obtained from a rabbit which died of chicken-cholera. Result: Died in fifteen hours. P.M.: Positive.

26th July.—One pigeon inoculated with a broth-culture obtained direct from a guinea-fowl dead of chicken-cholera. Result: Died in sixteen hours. P.M.: Positive.

31st July.—Two pigeons fed with a broth-culture obtained from the Muscovy duck. Result: Both remained alive.

14th August.—Two pigeons inoculated with blood of a fowl dead of chicken-cholera (received from Bathurst, New South Wales). Result: One died in sixteen hours; the other in seventeen hours. P.M.'s: Positive.

24th September.—Two pigeons fed with a broth-culture of chicken-cholera microbes. Result: Both remained alive.

22nd November.—One pigeon fed with a broth-culture of chicken-cholera. Result: Remained alive and showed no signs of sickness.

9th March.—One pigeon inoculated with a broth-culture obtained from a king-parrot which died of chicken-cholera. Result: Died in eighteen hours. P.M.: Positive.

11th April.—One pigeon inoculated with a broth-culture of chicken-cholera. Result: Remained alive.

14th April.—One pigeon inoculated with a broth-culture of chicken-cholera. Result: Died in twenty hours. P.M.: Positive.

15th April.—One pigeon inoculated with blood from a fowl which died of chicken-cholera. Result: Remained alive.

19th June.—One pigeon inoculated with a broth-culture of chicken-cholera. Result: Died in thirty hours. P.M.; Positive.

25th June.—One pigeon fed with a broth-culture of chicken-cholera. Result: Remained alive; and on 1st July was inoculated with a broth culture of chicken-cholera. Result: Died in fourteen hours. P.M.: Positive.

20th July.—One pigeon fed with a broth-culture of chicken-cholera. Result: Remained alive.

24th July.—One pigeon inoculated with a broth-culture of chicken-cholera. Result: Died in twenty hours. P.M.: Positive.

25th July.—One pigeon inoculated with a broth-culture of chicken-cholera. Result: Died in nine hours. P.M.: Positive.

OTHER BIRDS.

2nd October, 1895.—Two bronze-wing pigeons (freshly caught) were fed with the liver of Rabbit X.* Result: 15th October, still alive. Fed a second time with a virulent broth-culture of chicken-cholera. Result: One died in two days. P.M.: Positive.

17th October, 1895.—The remaining pigeon was fed again with the liver of the dead one. Result: 29th October, still alive and healthy.

2nd October, 1895.—Two Muscovy and one Aylesbury duck were fed with liver and other internal organs of rabbit X.* Result: One of the Muscovy ducks died in four days. P.M.: Positive. The other Muscovy duck became very drowsy and sick with diarrhœa for several days, but gradually recovered. The Aylesbury duck never exhibited any signs of sickness whatever.

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* Rabbit X died after being inoculated with a virulent broth-culture of chicken-cholera.

19th September, 1895.—Two king-parrots fed with a virulent broth-culture of chicken-cholera obtained direct from a rabbit. Result: One died in twenty-four hours; the other in thirty hours. P.M.'s and microscopical examinations proved that both had died from chicken-cholera.

Observations on Poultry allowed to Run in the Yard where Rabbits Experimentally Infected with Chicken-Cholera were kept in Cages.

Ever since I commenced experimenting with chicken-cholera in June, 1895, up to the present time, December, 1896, I have allowed a number of poultry (varying from thirty to fifty head) free access to pick up any scraps that might occasionally fall to the ground from the infected rabbits' cages; moreover, whenever the cages were cleaned out, the waste material was always thrown out for the fowls to pick over. In consequence, as might readily be supposed, there was an occasional outbreak of the disease among the fowls; but as I was able to prove that the disease, although sometimes of a virulent type, was easily controlled and practically stamped out with the loss of only a minimum number of fowls, by paying special attention to hygienic measures and resorting to complete isolation and segregation of the infected birds immediately they exhibited signs of sickness.

26th July, 1895.—On this date the first noticeable outbreak occurred, when two hens, which sickened, were isolated from the rest; they exhibited all the usual symptoms of chicken-cholera, viz.:—Ruffled feathers, drooping wings, and became quite drowsy for three days, when they began to pull round and recovered. When completely well, they were allowed to run with the other fowls.

24th October, 1895.—On this date a hen became suddenly sick with acute diarrhœa, and all the other usual symptoms of chicken-cholera; it was at once isolated in a thoroughly limewashed cage.

The sickness lasted four days, when the hen gradually recovered and was turned loose with the other fowls.

3rd December, 1895.—Three fowls became sick on 5th December; one died after an acute attack of diarrhœa. P.M. and microscopical examinations proved that death was due to chicken-cholera. Cultures on agar, gelatine, and in broth also gave positive results. The other two fowls completely recovered.

11th December.—A fowl which appeared mopy, without any signs of diarrhœa, on the previous evening, was found dead in the fowl-house on this date. P.M. revealed chicken-cholera, and microscopical examination of the liver showed myriads of typical bacteria. Cultures from the blood on agar and in broth likewise yielded positive results.

7th January, 1896.—Two fowls suffering from diarrhœa were placed in a small cage. One died on the 8th, and the other on the 9th January. P.M. in both cases: Positive. Bacteria very sparsely distributed throughout the liver and spleen; cultures yielded positive results.

20th November.—No more deaths occurred until this date, when a fowl became very sick and mopy with diarrhœa; in forty-eight hours it died. On examination it was found to have succumbed to an attack of chicken-cholera. P.M. appearances: Typical. Bacteria numerous, especially in the liver.

From this date up to the present time I have not observed a single fowl to show any signs of sickness, although the waste material from the rabbits'

cages has still been thrown out to the fowls. It might be argued that the fowls have acquired immunity; but this does not hold good, since every few weeks several fresh fowls from different localities have been introduced.

My object in bringing these observations under notice is to point out that, providing these urgent measures had not been taken in time to segregate the sick birds, numbers of the remaining ones would certainly have become infected, and the disease would have undoubtedly assumed an epidemic form, and possibly have been attended with heavy losses.

In view of these facts I would advise all poultry farmers, and especially those who breed fowls for fancy and show purposes, to at once isolate all birds that show signs of sickness, no matter what the nature of the disease may be.

Cage Birds accidentally infected with Chicken-Cholera Germs.

Three canaries and two coloured Croydon finches, which were kept in an aviary, died of chicken-cholera on different dates during the months of February, March, and June, 1896.

The sand used in this large cage was obtained direct from a poultry-yard where several fowls had been kept suffering from chicken-cholera. The progress of the disease in this instance was speedily arrested by using the sand from the same yard after being thoroughly baked or sterilised (thus destroying the vitality of any micro-organisms which might be present in the sand before placing it in the cage.

This paragraph should be of immense interest to all breeders of canaries and other fancy cage birds.

Notes on Native Birds found Dead in and around the Dilltoppa Paddocks.

During the investigations at Dilltoppa, although I was unable to trap any wild birds for experimental purposes, I occasionally had an opportunity of examining dead birds that were found in and around the experimental paddocks.

No sooner had the camp been established than the crows and hawks commenced building their nests in the coolabah and yapunyah trees along the banks of the creek close by.

The food of these carnivorous and carrion birds for several weeks mainly consisted of rabbits that had died of chicken-cholera.

The bodies of only twelve birds of different species were found, viz.:—

Date.	Description of Bird.	Where found.	Result of Examination.
1896.			
19 Sept. ...	1 woodpecker	Enclosure A	Negative.
2 Oct. ...	1 quail	,, C	Positive.
2 ,, ...	1 top-knot pigeon ...	,, C	,,
2 ,, ...	1 hawk	,, C	,,
2 ,, ...	1 wagtail	,, C	,,
13 ,, ...	1 crow	,, A	Negative.
21 ,, ...	1 spoonbill	,, A	,,
22 ,, ..	1 crow	Outside Enclosure A ...	,,
22 ,, ...	1 crow	,, ,, A ...	Positive.
4 Nov: ...	1 parrot	,, ,, C ...	,,
17 ,, ...	1 top-knot pigeon ...	,, ,, C ...	,,
20 ,, ...	1 hawk	,, ,, B ...	Negative.

From these observations it may be gathered that carrion birds, such as hawks and crows, although continually feeding on rabbits that have died of virulent chicken-cholera, are only very slightly susceptible to the disease.

Chicken-cholera is a disease which readily assumes an epidemic form among poultry or other domesticated birds which are restricted to a limited enclosure, portions of which may be protected from the sun's rays. The first birds that are attacked suffer from acute diarrhœa. The excrement, containing the active microbes, is dropped about by the infected birds all over the enclosure, consequently the remaining healthy birds readily contract the disease by picking up grit and food which is contaminated by this excreta; but as the conditions under which wild birds live are so entirely different in every respect, the probability of the disease assuming an epidemic form is reduced to a minimum, the principal reason being, as has been demonstrated by carefully-conducted experiments, due to the germicidal action of the sun's rays.

It is conceivable that the birds in the foregoing table contracted the disease in the following manner:—

The pigeons, parrot, and quail, being grain-eating birds, picked up and ate some of the infected pollard.

The wagtail, being an insectivorous bird, evidently became infected by feeding on flies that had settled on the dead rabbits; while the hawk and crows must have contracted the disease through feeding on rabbits dead of chicken-cholera.

Native Dogs, Crows, and Hawks.

The investigations at the Dilltoppa camp and enclosures were greatly handicapped at the commencement by the constant visits of native dogs in the night-time, and even during the daytime.

It was impossible to ascertain exactly the number of rabbits that died during the carrying out of the large experiment in Enclosure C, for no sooner did a rabbit die during the night than it was immediately seized and eaten by the native dogs, and if during the daytime it was torn to pieces and eaten by the crows and hawks.

To give some idea of the prevalence of the dingoes, hawks, and crows, I may mention that during the period the experiments were being conducted, when some hundreds of rabbits died in the large Enclosure C, the bodies of only five rabbits were found intact; but in these particular cases it was found, on P.M. examination, that death had taken place just prior to their bodies being discovered.

Every morning, before sunrise, the crows could be seen hovering over the various enclosures in dozens—in fact, I may say at times there were hundreds—waiting, perchance, for some rabbit to die.

Of the rabbits that were destroyed by birds, it was always possible to find the skull and feet, consequently it was always possible to make a microscopical examination of the blood-vessels found in these parts, and with few exceptions cultivations could be made on agar-agar, &c., in order to determine the presence or otherwise of bacteria.

With rabbits destroyed by native dogs, however, it was quite different, for they rarely left anything behind beyond an occasional portion of a foot.

At times it became somewhat difficult to keep up the supply of healthy rabbits for control purposes at the camp, consequently a considerable amount of trapping outside the enclosure had to be resorted to. A number of wire cages about 4 x 4 x 4 feet were placed around the various warrens, with a wire funnel bolt leading from the burrow to each cage, and the remaining outlets from the warrens stopped with logs and branches of trees.

The trap cages were erected in the evening, but on examining them the following morning we frequently found that the dingoes had torn open the wire netting with their teeth and extracted the rabbits. On one occasion six out of the seven traps were destroyed in this manner in one evening.

The boundary-rider employed in trapping rabbits for me at Kooliatta frequently had similar experiences.

In view of the continued depradation of the dingoes it was deemed advisable to employ some method of destroying them, consequently strychnine was produced and poison baits laid on what were considered the most suitable spots. The laying of the poison baits was not attended with very satisfactory results, for, although fresh (poisoned) baits were laid daily, very few of them were taken, and only three dead dogs were found in as many months; evidently they preferred to eat rabbits that had died from chicken-cholera (which disease would cause them no inconvenience whatever) rather than the poisoned beef or mutton.

Dingoes jumping Fences.—During the wet weather at Dilltoppa it was an extremely easy matter to track dingoes from one paddock to another over the various fences. On one occasion I followed the track of a native dog that had jumped the rabbit fences around the enclosures five times in the space of 1 mile. On another occasion I saw a dingo eating a full-grown rabbit that had just recently been killed near the inner side of the fence of Enclosure B. On its becoming aware of my presence it immediately jumped the fence and ran across the rext paddock, and after clearing another fence finally disappeared into some thick scrub.

SECTION V.

Experiments showing the effect of direct Sunlight and Desiccation on the Bacteria of Chicken-Cholera.

In order to determine the length of time the chicken-cholera germs, when mixed with pollard, will retain their virulent properties when exposed to the direct rays of the sun, and how long they will withstand desiccation, the following experiments were carried out:—

(*A.*) A portion of the liver of a rabbit dead of virulent chicken-cholera was mashed up with a little water and about 1 pint of pollard. The mixture, which was of the consistency of dough, was cut up in small pellets $\frac{1}{2}$ inch square. These pellets were exposed in lots of three to direct sunlight for periods of from one to six hours, and afterwards given as food to a definite number of rabbits, each having only one pellet.

Table showing the result of this experiment:—

Experiment.	Exposure to Sunlight.	Number of Rabbits fed.	Deaths due to Chicken-cholera.
(*a*)	1 hour	3	2
(*b*)	2 hours	3	1
(*c*)	3 ,, ...	3	....
(*d*)	4 ,, ...	3	....
(*e*)	5 ,, ...	3	....
(*f*)	6 ,, ...	3	....
Total	....	18	3

(*B.*) In this experiment the pellets of pollard were infected with a virulent broth-culture of chicken-cholera.

Table showing the result of this experiment:—

Experiment.	Exposure to Sunlight.	Number of Rabbits fed.	Death due to Chicken-cholera.
(*a*)	1 hour	3	1
(*b*)	2 hours	3	....
(*c*)	3 ,, ...	3	....
(*d*)	4 ,, ...	3	....
(*e*)	5 ,, ...	3	....
(*f*)	6 ,, ...	3	....
Total	....	18	1

(*C.*) Experiment showing the effect of desiccation on pellets of pollard infected with the same material as used in experiment *A*, namely, the liver of an infected rabbit.

Table showing the result of this experiment:—

Experiment.	Effect of Desiccation for—	Number of Rabbits fed.	Deaths due to Chicken-cholera.
(*a*)	1 day	3	2
(*b*)	2 days	3	3
(*c*)	3 ,, ...	3	3
(*d*)	4 ,, ...	3	....
(*e*)	5 ,, ...	3	....
(*f*)	6 ,, ...	3	....
Total	....	18	8

(*D.*) In this experiment the same process was repeated, with the exception that the pellets of pollard were infected with a virulent broth-culture.

Table showing the result of the experiment:—

Experiment	Effect of Desiccation for—	Number of Rabbits fed.	Deaths due to Chicken-cholera.
(*a*)	1 day	3	3
(*b*)	2 days	3	1
(*c*)	3 ,, ...	3	1
(*d*)	4 ,, ...	3	....
(*e*)	5 ,, ...	3	....
(*f*)	6 ,, ...	3	....
Total	....	18	5

Remarks.—All the above experiments were controlled by feeding three rabbits with one pellet each of the same pollard before exposure, with the result that they all died of chicken-cholera.

The minimum and maximum shade temperatures during the experiments were 74 degrees Fahr. and 103 degrees Fahr. respectively.

From these experiments it will be seen that pellets of pollard infected with chicken-cholera microbes are rendered completely sterile or innocuous after three (3) hours' exposure to the direct rays of the sun, and also after four (4) days' desiccation in the shade.

Experiments with Old and Attenuated Cultures of Bacteria of Chicken-Cholera.

It is a well-known fact to bacteriologists that certain species of pathogenic bacteria, if cultivated continually through successive generations on artificial nutrient media without being passed through some susceptible animal, will eventually become inert or attenuated. The degree of attenuation, of course, depends on the length of time the organisms have been artificially cultivated, and also to some extent upon the age of the animal experimented upon—*i.e.*, a culture may be so attenuated that even a large dose will not kill an adult, while a mere trace is sufficient to produce a fatal effect in a young animal of the same species. The same attenuated micro-organism may acquire virulent properties, and its virulence be increased by being passed through a number of young animals without the intervention of artificial culture media.

On 23rd June, 1895, I prepared a number of broth-cultures from a rabbit that died in fourteen hours after being fed with a virulent culture of chicken-cholera derived direct from a Muscovy duck dead of this disease. These broth-cultures, after twenty-four hours' incubation at 40 C., were run into small sterilised pipettes and hermetically sealed at both ends. I also inoculated a number of other broth-cultures, which were carried through twenty successive generations (sub-cultures being made every three weeks) for fourteen months without being passed through any susceptible animal.

On 6th September, 1896, six rabbits (three parts grown) were selected for the purpose of testing the respective properties of the broth-culture of chicken-cholera: (A) which had been hermetically sealed for fourteen months; and the culture (B) derived from the same source, which has been cultivated through twenty successive generations extending over sixty weeks.

(1.) Experiment with old cultures (A) hermetically sealed in pipettes: One rabbit inoculated; two rabbits fed, and placed in the same cage with the former. Result: All became very sick and drowsy within sixteen hours. The inoculated one died within nineteen hours, and one of the fed ones died in twenty-two hours. P.M.: Positive (in both cases). The other fed one gradually recovered, and at the present time is mother of six young ones.

(2.) Experiment with old cultures (B) cultivated through twenty generations artificially. One rabbit inoculated; two rabbits fed. Result: None of the three showed signs of sickness during the four succeeding weeks they were kept under observation.

The results of these experiments are exceedingly interesting and invaluable, for, should the Government deem it advisable that this method of rabbit destruction be carried out by stockowners themselves, it will be absolutely necessary that the virulent cultures on agar-agar for inoculating the bottles of broth be obtained direct from the Bacteriological Laboratory of this Institute, where the disease can be kept up to the very highest degree of virulence, and where culture tubes can be inoculated direct from an animal that has died from the disease of short duration.

The experiments also prove that cultivations of only one remove from an animal will not become attenuated or lose any of their virulent qualities if utilised within a reasonable time from the day they are posted from the Laboratory.

FURTHER EXPERIMENTS WITH OLD AND ATTENUATED CULTURE OF CHICKEN-CHOLERA, CULTIVATED ARTIFICIALLY THROUGH SUCCESSIVE GENERATIONS IN BROTH AND ON AGAR-AGAR SINCE AUGUST, 1891, WITHOUT BEING PASSED THROUGH ANY SUSCEPTIBLE ANIMALS.

20th June, 1895.—One rabbit (A) inoculated with broth-culture; one rabbit (B) fed with broth-culture; one mouse (C) inoculated with broth-culture. Result: All three remained alive.

5th July.—One rabbit (D) inoculated with broth-culture; one rabbit (E) fed with broth-culture. Result: Neither of these showed signs of sickness.

16th July.—One rabbit (F) inoculated with broth-culture; one rabbit (G) fed with broth-culture and placed with two healthy rabbits. Result: All remained alive.

1st November.—One rabbit (young) (H) inoculated with broth-culture. Result: Died in sixty hours. P.M.: Positive.

4th November.—One rabbit (I) fed with heart of rabbit H. Result: Died in twenty hours. P.M.: Positive.

One rabbit (J) fed with liver of rabbit H. Result: Died in twenty hours. P.M.: Positive.

One guinea-pig (K) fed with liver of rabbit H. Result: Remained alive.

Two rabbits (L, M) placed in same hutch with I, J. Result: L remained alive; M died in fifty hours. P.M.: Positive.

5th November.—One guinea-pig (N) fed with liver of rabbit I. Result: Remained alive.

6th November.—Three rabbits (O, P, Q) fed with dung of rabbit M. Result: All remained alive.

15th November.—Four rabbits (R, S, T, U) fed with broth-culture. Result: R died within four and a half days. P.M.: Positive: S, T, U, remained alive.

Two pigeons (V, W) fed with broth-culture. Result: Both remained alive.

One fowl (X) fed with broth-culture. Result: Remained alive.

20th November.—One rabbit (Y) fed with liver of rabbit R. Result: Died in twenty-two hours. P.M.: Positive.

Two rabbits (Z, A) placed in same hutch with Y. Result: Z died in forty hours. P.M.: Positive; A remained alive.

One rabbit (B) (adult) with four young ones fed with liver of R. Result: Died in thirty hours. P.M.: Positive; no diarrhœa. The young ones remained alive.

22nd November.—One fowl (C) fed with liver of B. Result: Remained alive.

One pigeon (D) fed with liver of B. Result: Remained alive.

Two rats (E, F) fed with liver of B. Result: Both remained alive.

SECTION VI.

(*a*) List of Plants Eaten and Destroyed by Rabbits in South-west Queensland.

Mr. J. F. Bailey, of the Colonial Botanist's Department, who accompanied me during my second trip through the Bulloo district, has been kind enough to furnish me with the names of the various plants that are eaten, and in some instances totally destroyed, by the rabbits in this South-west district:—

Technical Term.	Local Name.	Eaten and Destroyed.
Kochia villosa	Cotton-bush	Whole plant.
Eremophila bignoniæflora	Quirramurrah	Bark and leaves.
,, Mitchelli	Sandalwood	Bark.
,, maculata	Native fuchsia... ...	,,
,, longifolia	....	,,
,, polyclada	....	,,
Rhagodia spinescens	....	,,
,, parabolica	....	,,
Dodonæa attenuata	....	
Jasminum lineare	....	
Acacia aneura	Mulga	Bark and leaves
,, salicina...	....	,, ,,
Chenopodium auricomum	Blue-bush	Whole plant.
Muhlenbeckia Cunninghamii ...	Lignum...	,,
Atriplex nummularia	Old Man Salt-bush ..	Whole plant and roots.
Cassia Eremophila	....	Bark.
,, phyllodinea	....	,,
Hakea leucoptera	Needle-bush	,,
Santalum lanceolatum	....	,,
,, angustifolium	....	,,
Eucalyptus ochrophloia	Yapunyah	Bark and leaves.
,, hemiphloia	Gun-top box	,, ,,
,, microtheca	Coolabah	,, ,,
,, rostrata	Water-gum	,,

In addition to the above list of plants all the different grasses and varieties of herbage, which were not growing at the time of our visit on account of the dry weather, are also freely eaten by the rabbits.

After spending several months on the Bulloo River one feels almost inclined to abbreviate the above list, and say that rabbits with few exceptions eat every kind of vegetation that grows in these districts. As far as I am able to ascertain by direct observations the gidyea and beefwood appear to be the only trees that rabbits leave untouched, even during times of drought.

(*b*) Observations on Parasites affecting Rabbits living under Natural Conditions in the Bulloo District.

In making *post-mortem* examinations of rabbits that had died from chicken-cholera at Dilltoppa, and those that I caught in other places, I was careful to take notes as to the presence or otherwise of the various internal and external parasites affecting rabbits.

The only parasites which I discovered were as follows:—

The small bladder-worm (*Cysticercus pysiformis*).
Liver Coccidia (*Coccidium oviforme*).
Scrub mite (*Sarcoptes minor*).
Scrub tick (*Ixodes recinus*).

Small Bladder-worm.—As the name implies, it is a small watery bladder or cyst about the size of a pea, and found attached to the outer surface of the intestines, stomach, and liver. Sometimes as many as ten or twelve are found in clusters resembling a small bunch of grapes, and on one occasion thirteen were found in one cluster, while in twenty-nine other cases they were either singly or in small clusters of threes and fours on various parts of the omentum.

This familiar form of parasite is found to be very common in other parts of the Australian Colonies and New Zealand; also in the domesticated and wild rabbits of various parts of Europe. In reality this little bladder-worm is the larval or cystic stage of the *Tænia serrata*, a tapeworm commonly found in the intestines of both wild and domesticated dogs.

The dog becomes infected with *Tænia serrata* in eating the viscera of rabbits and hares containing these *Cycticerci*.

Liver Coccidia.—Out of between 600 and 700 rabbits that I examined during my two trips in the South-western districts, I only found three with their livers affected with the parasite. In one liver the coccidial bodies were in an active stage of development; while in the other two, the connective tissue was so dense around the nodule that the encapsuled coccidial bodies appeared to be in a degenerative stage.

Scrub Mite.—This microscopic form of acarina is only occasionally found on rabbits in Australia, but is very common among rabbits in Europe.

It rarely causes any cutaneous lesions unless the animal is extremely sensitive to the slight irritation produced. In some cases, however, it produces acute pruritus or intense hitching, which compels the rabbits to rub against trees, &c., and to scratch themselves with their hind feet. Under such conditions the hair falls off from the affected parts, and grayish-white crusts appear. These crusts become very thick and adherent, and when removed the skin is red and bleeding. Immediately under the crusts the *Sarcoptes* are found.

It is believed that under certain conditions this disease is extremely contagious, and may assume an epidemic form, and be attended with fatal results; in fact (according to the Rabbit Commission's Report of 1889), it was proposed to introduce it into Australia for the purpose of destroying the rabbits.

I only met with this particular parasite in two rabbits.

Scrub Tick.—These were found on the ears of three rabbits without apparently causing them any inconvenience.

(*c*) Rabbits travelling north.

The tendency of rabbits to always travel in a northerly direction is, I believe, an acquired instinct.

When the rabbits, some time after their introduction into Victoria, increased in such numbers that it was necessary for them to push out into the country in search of fresh pastures, in order to prevent them becoming decimated by starvation, they found that the country to the north, where the natural food was more plentiful and luxurious, proved to be more congenial to their requirements.

Since that time this acquired instinct has developed to such a high degree of perfection that it might almost be termed hereditary.

In travelling over many infested districts of Queensland and New South Wales, one cannot help noticing how conspicuous the rabbit pads or tracks are on the south side of an east and west fence, although rabbits may be equally numerous on both sides.

I have seen this tendency of the rabbit to go north illustrated very conspicuously on some of the rabbit fences in the following ways :—

(*a.*) In riding along the south side of an east or west fence, and meeting a rabbit (either young or old), it will not run away south into the bush, but, continuing to run along the fence, endeavouring at intervals of every few minutes to get through, or expecting to find a hole in the wire netting, or the fence to turn at right angles in a northerly direction. Should the fence turn northerly, as it does in some parts of the flooded country on Bulloo Downs, the rabbit will not continue its course along the fence, but immediately turn in a north-easterly or north-westerly direction, as the case may be.

(*b.*) How different if a rabbit is met with while riding along the north side of an east and west fence. It will run along the fence for a short distance only, and then suddenly turn due north and disappear into the bush.

(*c.*) In the beginning of September I accompanied Mr. A. C. MacDonald, of Bulloo Downs, and Mr. Mitchell, of Pitteroo, along the flood-water fence from Tantangella to Booka Booka. When near the latter place we found a hole burrowed from the south side right down beside a post, and under the fence (which was sunk in the sand to a depth of fully 12 inches), and up the other side. The most striking feature about it was that all the footprints and tracks clearly proved that hundreds of rabbits had gone through from the south side, and apparently not one had come through from the north side.

(*d.*) In the case of the ear-marked rabbits that had climbed over the fences of the Dilltoppa paddocks, and were trapped some 2 miles away in another enclosure, one would feel inclined to imagine that, as they were brought from Koopa, some 30 miles away, there would be a tendency for these rabbits to make back home again; but this was not so. Koopa sandhill is situated nearly due south from Dilltoppa, while the ear-marked rabbits, although introduced in the south end of the enclosure, were (those that climbed the fences) always trapped, in every instance, due north from where they had been introduced.

(*e.*) In one particular instance on the Bulloo Downs fence I noticed that the wire netting had been broken, leaving a hole about 3 inches square, where some hundreds of rabbits had passed through from the south to the north side, although the vegetation and surroundings were equally as good on one side as on the other.

(*f.*) All along the various fences on sandy country there is ample evidence of the rabbits attempting to burrow underneath; but, with few exceptions, these burrows are invariably on the south side.

(*d*) Miscellaneous Notes on Rabbits.

As I had an opportunity of breeding our Australian rabbits and watching their habits, &c., for the past five years, it may not be out of place if in the present report I record some of the observations I have noted on their life-history, knowing full well, as I do, the extraordinarily vague idea some people possess concerning the habits of these rodents.

Because rabbits, whose ancestors were imported from England, have become acclimatised in Australia, many people believe that the does have many more young ones at a birth, also that they arrive at the age of puberty

much earlier than rabbits living in the more temperate climate of Northern Europe; hence their extraordinary multiplication in these colonies.

This is merely a conjecture by persons totally unacquainted with the nature and habits of rabbits.

One would naturally suppose that in order to acquire definite reliable information concerning rabbits the very best people to apply to for such information would be inspectors, overseers, boundary-riders, and rabbit-trappers on the various rabbit fences. From personal experience I must certainly say that this class of people, either from lack of energy or from the constant monotonous lives which they lead, the unvaried natural surroundings, and the few persons they are acquainted with to exchange ideas, are most unobservant; consequently are not able to impart very much information concerning the nature and habits of rabbits, or anything worthy of note bearing on the rabbit question.

It has frequently been asserted that rabbits have as many as ten and twelve young ones at a litter. From my observations this is altogether erroneous.

Whenever opportunity afforded in making *post-mortems* at Dilltoppa and elsewhere, I always kept a record of the number of fœtal rabbits contained in the uterus of all pregnant does.

At the Stock Institute in Brisbane I have bred upwards of thirty litters, and made *post-mortems* on a number of experimental does. These joint records form invaluable data as to the number of young ones a fully developed female will give birth to.

The results of these observations are recorded as follows:—

Number of Does.	Number at irth.	Total Number of Young Rabbits.
1	7	7
13	6	78
19	5	95
32	4	128
11	3	33
6	2	12
3	1	3
85	8	356

It will be seen in the foregoing table that out of eighty-five doe rabbits only one had seven at a litter, while 60 per cent.—namely, thirty-two and nineteen—had only four and five each respectively at a litter.

The period of gestation—*i.e.*, the time that a doe rabbit carries her young—is twenty-eight days.

The young are born without any hair, and their eyes are not opened until the ninth day. If the mother is in good condition and has plenty of milk, the young ones will commence to leave their nest and run about on the twelfth day, and on the fourteenth day feed on green food, potatoes, &c., and on the twentieth day they are old enough and perfectly capable of taking care of themselves. Here I may mention the fact that young rabbits from three to six weeks old can get through $1\frac{1}{2}$-inch mesh in a comparatively easy manner.

I have frequently heard it stated that rabbits commence to breed when they are six weeks old; this, however, is not the case. I have never known rabbits, under any condition whatever, to commence breeding until they are sixteen weeks old; even then their first litter rarely consists of more than three or four young ones.

Under the most favourable conditions a rabbit will not have more than six litters within the twelve months, aggregating in all approximately about

thirty young ones. Assuming, therefore, that 50 per cent. of all litters are females, and that they do not commence breeding until they are four months old, and then only every two months, each fully developed female rabbit is capable of being the producer of 190 young ones in twelve months.

RABBITS SWIMMING.

It may not be generally known that the rabbits in this district are really excellent swimmers, more particularly during the wet season, when the Bulloo River waters spread over the country for several miles. Mr. Macdonald informed me that during the wet season on the Bulloo, numbers of rabbits are destroyed by the station blacks and their dogs on the island sandhills in the flooded country, but during some of the hunting trips numbers of rabbits escape by taking to the water and swimming across to some adjacent island. I have on several occasions when hunting rabbits out of the lignum swamps along the banks of a waterhole seen them when pressed take to the water, and swim across to the other side.

(*e*) Notes on the Colour of Rabbits.

In the Bulloo district I met with rabbits of various colours, viz.:—Gray, gray and white, sandy, sandy and gray, white, black, and black and white. The prevailing colour is gray, with a tendency in a number of instances to become sandy, while in some parts, where the sand is deep-red, numbers of rabbits may be seen with a fur of a decided reddish-sandy colour, which bears a striking resemblance to the colour of the surrounding sandhills on which they live and burrow. Here we have undoubtedly a characteristic example of protective mimicry, which must materially assist these animals in escaping undetected from their natural enemies (such as dingoes, hawks, and crows).

It is more than probable that in the course of time all the rabbits, if left undisturbed on these sandhills, would be possessed of coats harmonising in colour with the general effect of their surroundings. Occasionally black rabbits may be met with, but usually not more than one or two are found on one sandhill; moreover, those that I have trapped or shot have invariably been old bucks. So conspicuous is this colour in these districts that there is a possibility of their becoming extinct at a very early date. The other scarcer-coloured rabbits are the gray and white, and black and white. Of the latter, I only met with one case.

(*f*) Notes on Rabbits barking Trees.

A peculiar habit of the rabbit on some sandhills is to gnaw the bark from one particular species of tree, and leave other edible species in the same locality untouched.

During my stay at Koopa and Kooliatta I found one large sandhill, situated about half a mile from the river on a large blue-bush plain, where all the small species of plants, such as salt-bush, cotton-bush, grasses, &c., had been entirely eaten out by the rabbits. The remaining vegetation consisted principally of mulga, cassia, quirra-murra, hop-bush, needle-bush, and sandalwood—all more or less equally distributed over the sandhill. At the south end nearly every needle-bush was barked to a height of 3 feet from the ground, while the other species of trees were not touched. At the north-east end all the hop-bush and cassia were barked to a height in some instances to nearly 6 feet, while the other bushes were left untouched. In another part the mulga was almost all destroyed through being ringbarked by the rabbits, to the exclusion of all other trees.

The Fodder-value of Saltbush.

F. B. GUTHRIE.

The value of saltbush as a fodder is too well known to require special reference at this time of day.

The main object of the following analyses was to compare the feeding-value of the plant in its native state in different parts of the Colony, with one another, and with the plant grown as a cultivated crop. For this purpose Mr. George Valder kindly supplied me with a sample of *Atriplex nummularia* (old man saltbush), grown by him at Wagga.

This is compared in the following table with a specimen of the same plant (uncultivated) from Bourke.

All the plants referred to were named by my friend Mr. J. H. Maiden, Director of the Botanic Gardens. Unfortunately, the identification was not, in all cases, possible, owing to the absence of fruiting specimens. Of the first pair, however, there was no doubt.

	A. nummularia. Grown at Wagga. (Under cultivation.)	*A. nummularia.* From Bourke. (Uncultivated.)
Moisture	75·11	56·73
Oil	·56	·67
Digestible fibre	8·21	11·59
Woody fibre...	3·29	3·93
Soluble albumenoids	·50	1·76
Insoluble albumenoids	2·56	3·54
Soluble ash	5·77	14·14
Insoluble ash	·15	2·04
Chlorophyll, amides, and other extractives (by difference)	3·85	5·60
	100·	100·
Total nitrogen	·74	1·20
Amide nitrogen	·25	·36
Percentage of common salt in ash ...	36·6	56·6

The great difference in the percentage of moisture is due to the fact that the Wagga specimens had not so far to travel, and were more carefully packed.

In order to obtain a fair comparison, the above table is calculated to dry substance, as follows :—

Comparison of cultivated and uncultivated specimens of *Atriplex nummularia*—Calculated to dry substance :—

	A. nummularia. Grown at Wagga. (Under cultivation.)	*A. nummularia.* From Bourke. (Uncultivated.)
Oil	2·25	1·54
Digestible fibre	32·98	26·78
Woody fibre	13·21	9·08
Soluble albumenoids	2·01	4·06
Insoluble albumenoids	10·28	8·19
Soluble ash	23·11	32·68
Insoluble ash	·60	4·71
Chlorophyll, amides, and other extractives (by difference)	15·56	12·96
	100·	100·
Total Nitrogen	2·97	2·76
Amide ,, ...	1·01	·80

The most striking differences here are the larger proportion of oil and digestible fibre in the cultivated specimen, and the lower proportion of ash. Particularly remarkable is the diminution of common salt in the cultivated sample.

The nitrogen compounds are more abundant in the Wagga sample, but an exceptionally large proportion is present as insoluble albumenoids.

Nearly 95 per cent. of the ash in the Wagga sample is soluble in water against 85 per cent. in the Bourke sample.

The following table shows the comparative composition of samples of saltbush from Bourke and Hay respectively :—

The names and locality of the specimens are as follows :—

A. *Atriplex nummularia*, from Bourke.
B. *Rhagodia parabolica*, ,,
C. *Atriplex halimoides* (mixed with another species of *Atriplex*), from Bourke.
D. *Rhagodia Billiardieri* (probably), from Hay.
E. *Atriplex angulata*, from Hay.
F. Unidentified, from Hay.

Analyses of Saltbush from Bourke and Hay, calculated to dry substance.

	A.	B.	C.	D.	E.	F.
Oil	1·54	2·06	2·10	1·88	3·27	1·83
Digestible fibre	26·78	22·17	23·06	18·91	10·20	26·99
Woody fibre	9·08	18·68	13·45	11·01	21·87	12·27
Soluble albumenoids ...	4·06	3·56	2·92	5·46	3·04	3·86
Insoluble albumenoids ...	8·19	6·93	3·56	8·53	2·91	5·97
Soluble ash	32·68	24·68	26·78	30·64	29·15	28·75
Insoluble ash	4·71	5·81	3·83	3·90	19·49	4·84
Chlorophyll, amides, and other extractives (by difference)	12·96	16·11	24·30	19·67	10·07	15·49
	100·	100·	100·	100·	100·	100·
Total Nitrogen ...	2·76	2·60	2·48	3·66	1·84	1·95
Amide ,, ...	·80	·92	1·44	1·42	·89	·58
Percentage of common salt in ash	56·6	44·7	59·5	44·3	49·9	59·7

The amount of water in the different samples examined was, as has been said, extremely irregular, some of the samples having become very dry in transit.

The percentages of water were as follows:—

A	56·73	D	63·41
B	41·86	E	38·64
C	40·48	F	50·88

The percentage of water in fresh saltbush is as high as 75 or over (see Wagga specimen).

It will, therefore, be seen that some of the above had lost a considerable proportion of their water, especially the smaller-leaved varieties.

It is noteworthy that the samples containing the largest proportions of water are the highest in nitrogen and albumenoids.

The amounts of soluble to insoluble albumenoids are in the proportion of 1 to 1½ or 2 except in the case of *A. angulata* from Hay, in which they are about equal.

This specimen is exceptional in other ways, notably in the large percentage of ash and the high proportion of ash insoluble in water, nearly half the total amount being insoluble in water in this sample, whereas in the other cases about one-eighth only of the total amount of ash is insoluble.

The above method of stating the results of analysis has the advantage of showing the proportion of the different constituents which are soluble or not and the amount of digestible fibre.

Unfortunately I am not able to lay my hand on many analyses of other fodders stated in the same way. The following analysis of a sample of hay from English meadow grass made in the laboratory of the Royal Agricultural Society of England and of a sample of *Paspalum dilatatum* hay, which is known locally as an excellent fodder, will serve to show the essential differences between the grasses and the saltbushes. These are also calculated to dry substance.

	Hay from English meadow grass (*Addyman*).	Hay from *Paspalum dilatatum*.
Digestible fibre	33·35	33·49
Woody fibre	26·65	31·35
Soluble albumenoids	1·14	1·54
Insoluble albumenoids	9·17	9 98
Soluble ash	2 55	4·83
Insoluble ash	5·42	2·29
Chlorophyll, amides, &c. (by difference)	21·72	16·52
	100·	100·
Total nitrogen	1·79	2·97
Amide nitrogen	·14	1·13

The striking difference between the saltbushes and the two fodders here compared is the very high percentage of saline matter (ash) in the saltbushes; they are correspondingly lower in fibre, and the amount of digestible ingredients is much higher. Their value as a fodder is therefore considerably higher.

Although this way of tabulating the results of analysis of fodder is in my opinion preferable to the shorter method usually adopted, it will nevertheless be advisable to express the results in the ordinary way in order to compare the composition of these saltbushes with the more ordinary fodder-plants, as it is difficult to get a sufficient number of results stated in the above form, whereas the analyses of fodders usually published (giving only the amounts of albumenoids, carbohydrates, fibre, and ash) are numerous and easily accessible.

For the sake of brevity only the mean of the analyses of the Bourke and Hay saltbushes will be given, and to avoid the discrepancies occasioned by the different degree of freshness of the samples, I have calculated all out on the basis of 75 per cent. water, which fairly represents the composition of fresh saltbush.

	Average of 3 samples from Bourke.	Average of 3 samples from Hay.	Sample from Wagga.
Water	75·00	75·00	75·00
Oil...	·47	·61	·56
Albumenoids (N x 6·25)	2·37	2·52	3·07
Carbohydrates	10·55	7·78	12·13
Woody fibre	3·52	3·98	3·30
Ash	8·09	10·11	5·94
	100·	100·	100·
Percentage of common salt in ash	53·06	51·03	36·06

The following gives for comparison the composition of some ordinary green fodders taken from the " Farmers' and Fruit-growers' Guide," page 119 :—

	Maize - Fodder.	Sorghum.	Lucerne.	Timothy Grass.
Water	79·3	79·4	71·8	61·6
Oil	·5	·5	1·0	1·2
Albumenoids	1·8	1·3	4·8	3·1
Carbohydrates	12·2	11·6	12·3	20·2
Woody fibre	5·0	6·1	7·4	11·8
Ash...	1·2	1·1	2·7	2·1

A comparison of the above shows that the saltbushes take a high place amongst green fodders, the amounts of carbohydrates and albumenoids being high, and the woody fibre relatively low.

The high content of mineral matters, especially of common salt, is of course characteristic.

In discussing their merits as fodder, it must not be forgotten that they possess natural advantages over the ordinary cultivated crop or pasture grasses. They flourish on land which will not support other nourishing plants; they resist drought to an exceptional degree; are indigenous and require no cultivation; are relished by stock, and are exceedingly prolific and easily propagated.

It would appear, however, in spite of the universal recognition of these facts by stock-owners, that there is some danger of these plants becoming less abundant than formerly, through overstocking and other causes. I have repeatedly heard stock-owners and visitors in the west during the recent severe drought lament this fact.

It seemed, therefore, that this is the proper time to call attention once more to the high nutritive value of these plants in the way I have done, by careful analysis and comparison with other fodder-crops.

In California they have imported a number of species from Australia for the purpose of experimenting with it on the alkaline soils of that State.

Here is what Professor Wickson says of *Atriplex semibaccata*, the variety which has shown the most successful results in California.

" *A. semibaccata* (a variety of prostrate growth) throve splendidly on alkali soils, which will not retain other useful growth. It attains a growth in one season of 16 feet in diameter, of thick-matted growth, yielding 20 tons of green feed to the acre. Probably two cuttings of 20 tons each can be made each season."

The following is the analysis of this plant grown in California, made by Mr. M. E. Jaffa:—

ANALYSIS OF *Atriplex semibaccata* (CALIFORNIA).

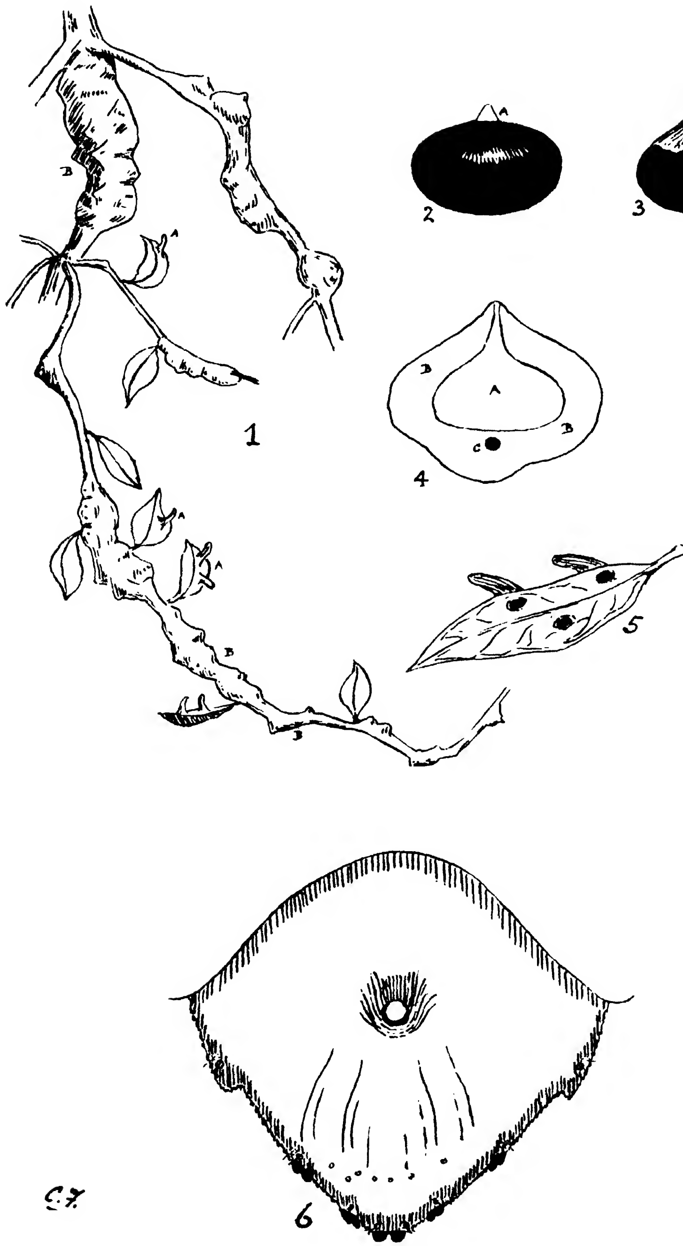
Water	78·03
Albumenoids	2·75
Nitrogen—free extract	10·41
Fat (oil)	·48
Fibre	3·75
Ash	4·58

The ash contains 40 per cent. common salt. This agrees very closely with the figures obtained as an average of the samples locally collected and examined, and exhibits the same diminution in ash and salt as was observed in the sample grown under cultivation at Wagga, the indigenous plants showing a higher percentage of ash and common salt.

If it is worth while to import saltbush seed for cultivation in California it is surely worth while to encourage these plants in our drought-stricken districts, if only to the extent of preventing them from being kept eaten down by over-stocking.

It should be possible, if it were seriously attempted, to assist their propagation materially, as they grow readily and prolifically from seed, from cuttings, and from the root.

In good seasons there seems to be no reason why saltbush should not be cropped like lucerne and conserved as dry fodder for times of drought.



A GALL-MAKING DIASPID.

1. Twig showing (A) male and (B) female galls (natural size). 2. Adult female—(A) pygidium (enlarged). 3. Adult female—(A) skin of second stage capping abdomen (enlarged). 4. Diagram of female gall—(A) chamber, (B) gall-walls, (C) heart of twig. 5. Male galls showing on face (enlarged). 6. Last segment of abdomen of female (enlarged).

A Gall-making Diaspid.

By C. FULLER.

Contrary as the ways of *Coccidæ* are, still one cannot help expressing some surprise at the discovery of a gall-making member of so uniform a group as the *Diaspinæ*. In 1895 I found at Toongabbie, some 20 miles west of Sydney, New South Wales, insect galls, which at first sight appeared to be those of an *Opisthoscelis*. An examination of a prepared specimen of one of the inhabitants, however, revealed the fact that the last segment of the abdomen presented diaspid characters. Want of time and an insufficiency of material prevented the more thorough study of this peculiar form. Quite recently I came across a somewhat similar, if not identical, gall in Western Australia, and I am now able to give a brief account of the species.

GROUP—DIASPINÆ.

Genus—*Maskellia*, gen. nov.

Adult females inhabiting galls formed on twigs; abdomen covered by exuviæ; antennæ and legs absent; last segment of the abdomen of normal diaspid character, flattened and chitenous, bearing appendages common to the group.

Adult males inhabiting tubular galls formed upon leaves. The habit of producing and inhabiting galls renders the erection of a new genus necessary, and I have much pleasure in dedicating it to Mr. W. M. Maskell, New Zealand's best-known entomologist.

Maskellia globosa, sp. nov.

(See Plate, Figs. i-vii.)

Adult female, black or purple-black; smooth, unsegmented, depressed globular; last segment of abdomen transparent, projecting. There are a few wrinkles encircling the base of the last segment. The cast skin of the second stage forms a hollow, sub-conical endusiam, capping the abdominal region (fig. 3 A), and filling up the entrance of the gall.

The last segment of the adult insect tapers rather acutely; the anal orifice is central, and the surface finely and evenly striated. There are no groups of "spinnerets," but a few small circular orifices are to be seen median of the orifice and the apex of the segment. There are six short lobes; the median are rounded at the apex. The second and third pairs are short and wide, and usually incised once at the apex. The third are further removed from the second than the second from the first. The margin of the segment is finely serrate, and almost laterad of the orifice it is prolonged, the part being sometimes thickened, resembling an extra lobe.

The plates are absent.

The opines are not conspicuous, and are arranged in the usual pairs—one upon the upper and one upon the lower surface. The first occur laterad of the median lobes; the second at the base of the second lobes; the third laterad of the third lobes and the fourth laterad of the marginal projection.

An examination of the second skin shows the posterior margin chitenous and rounded, bearing six small lobes, and fringed with normal serrated plates.

The female galls are green and red or brown, according to their age, and are formed upon the young twigs, great numbers usually growing side by side, producing an uneven, aborted growth. The apex of each gall is conical, and the oriface small. When formed singly the galls are uneven, globose excresences, somewhat longer than high. Height, 0·18 inch; width, 0·23 inch. Female chamber—contour pyriform; diameter, 0·08 inch.

Adult male, unobserved.

Male galls, small, elongated, striated longitudinally, green formed upon leaves; length, 0·12 inch. The galls protrude upon the opposite side of the leaf, the oriface being at the base instead of at the apex.

Larva unobserved.

Found on *Eucalyptus gomphocephala* (Tooart), Swan River, West Australia.

The Influence of Bees on Crops.

(Continued from page 493.)

ALBERT GALE.

Artificial Fertilisation.

"WHAT man has done man can do," is a very wise old saw, or a truism that cannot be disputed; and what insects have done, in many instances man can do to his advantage and the advantages of his race. These tiny workers are accredited with unfolding and throwing light upon many a discovery, and man is said to have received some valuable and useful hints by noting the methods or the results of some of their habits and constructions. Science is said to have taught us that insects have played no inconsiderable part in the development of the plant world; how the ocean was the birthplace and cradle of vegetable life, or how the early aquatic forms of it developed their terrestrial representatives, and these again from the lower forms of fruit and grain to the highest types we now enjoy. Whether it was by those disputable points "spontaneous generation" or evolution from "mere specks of green jelly" seen floating in the sea, and the variations, ensuing from their battling and struggling for life, and the "survival of the fittest," or the ones naturally selected and taken by man under his care and guardianship, matters not, as far as the power we now have in producing variations in the vegetable kingdom, and from these selecting the ones that will administer most to our medicinal and dietary wants, or those having ornamental colours and forms to please the eye and decorate our surroundings, and making life worth living, is immaterial to this portion of our subject.

That the bee is, by the part she plays in fertilisation, our greatest fruit-producer, must be conceded by those who have read these articles, and she is such an absolute adjunct to the orchardist and others, that to interfere with the beekeeper would be suicidal to all who are engaged in the reproduction of vegetable life.

In a previous article I mentioned that bees had been accredited with the destruction of some of our choicest annual vegetables by inoculation, and that, to a certain extent, they are guilty; but the want of knowledge in men who are engaged in the work of supplying or cultivating such vegetables is the true cause of the disappearance or injury to the varieties referred to. I have said the inoculation of annuals, for it is immaterial how the fruits and seeds of trees and such like that are reproduced by grafting, budding, cuttings, offsets, &c., are inoculated or cross-fertilised, because the immediate fruit or flower is in no way improved or injured by it. Cross-pollenisation does not show itself in the fruit or flower that has been so fertilised, but in the plant that is produced from that cross-pollenisation. You can discern an egg that has been laid by a Cochin hen that is running in a yard of mixed fowls by its colour, but from the egg you cannot

tell what the cross-bred chick will be; that will only show itself in the progeny resulting from the crossing. So it is in cross-pollenisation—the blossom or fruit does not show it, but the crossing is seen in the succeeding generation.

The way bees transfer the pollen grains from the anther to the stigma has been already described, and the simplicity of the method must be apparent to all.

The action of conveying it from place to place is in no way injurious, neither does the instrument used interfere with its vitality. An artificial instrument is as useful to convey it from flower to flower as a natural one, and the action would produce the same result. We have seen that pollen removed from the male flower and placed on the receptive organ of a female flower (*see* diagrams Nos. 4 and 5 of May number of *Agricultural Gazette*) produce fertile fruit. In members of the pumpkin family the sexual flowers are situated on different parts of the same plant, and the sexuality of the blossom is very readily distinguished. Taking that class of plant for our model, let us see how easily artificial fertilisation can be accomplished. The first step will be to secure in both sexual flowers immunity from visits of insects. To do this, if the same strain of pumpkin, &c., is to be retained, select two blossoms (male and female) on the same vine whilst in bud form—that is, some days before the flower opens. Enclose them with fine mosquito netting. Gauze-wire is better, because it cannot come into close contact with the opening flower. Care must be taken that the netting is sufficiently large to permit the full expansion of the flower. When the essential organs are mature—that is, in the case of the male flower, when the pollen comes away freely with the instrument used in its removal; and in the female when the central organ has a viscid appearance—remove the net covering from the male bloom first, and with a soft downy feather, or, better still, a small camel-hair pencil (brush), gently brush over the essential organ. If the instrument used be dark in colour it will be noted that a quantity of yellow dust (pollen) is adhering to it. Carry the brush gently to the female flower, remove its covering also, and softly apply the brush with its pollen to its central organ. As soon as the operation is completed be sure to recover the bloom that has been artificially fertilised. To ensure male and female bloom maturing at the same time it is necessary that male buds in various stages of development be selected and treated as above described.

The imperative necessity of artificially fertilising cucumbers, &c., or fruits that are grown under glass or indoor gardens, has long been recognised. In colder latitudes, where early cucumbers, melons, &c., are at a premium, the first morning duty of the man in charge is, as soon as the sun is sufficiently high, to go the rounds of his forcing-pits to overhaul the vines therein, note every female blossom, and taking a male flower in his hand, dust the pollen from it to the stigma of the receptive bloom. Every stigma so treated is morally certain to produce a fruit. But every one neglected is certain to be a failure as far as the production of a fruit is concerned.

What has been said in relation to pumpkin-fertilisation holds good with every other flower that is fertilised by insect agency, only the smaller the flower the greater care must be exercised, and the more patience necessary to ensure successful results. One fact must always be remembered—every seed requires a grain of pollen to ensure a plant from the seed sown; therefore be not parsimonious in the application of pollen, and also remember "enough is as good as a feast." The care necessary is to apply the brush with its pollen to the receptive organ with as soft and gentle touch as possible.

If hybridisation or cross-fertilisation be required, the same methods must be adopted.

Whatever species or even varieties are selected to operate upon for the production of something new, the greatest care in the selection of the sexes should be exercised. Perfect health is of the utmost importance. The pollen from the plant—we will call it A—should be used to fertilise B, and the pollen from B to fertilise A. The results from these crossings are often more successful than where this interchange is not used. The constitution in the sexes of two plants differ greatly. The pollen-bearing essential organs of one being far more vigorous than that of another, and the same differences are met with in the receptives of distinct species or varieties.

If hermaphrodite or bisexual blooms are to receive cross-pollenisation, they too must be guarded from the action of insects. The operation is a very delicate one. The flower-buds selected to transfer the pollen must be carefully watched, and as the anthers develop they must be lightly removed without injuring the stigma in the slightest degree, a finely-pointed pair of scissors being used for the purpose. Stamens, as a rule, develop earlier than the pistil.

The pollenisation of double flowers or blossoms is another delicate work, and needs extra patience. The extra number of petals in these is the result of abnormal treatment, which causes the stamens or pistil, and sometimes both, to fall back to flattened leaves.

Botanically speaking, all flowers are modified leaves. When the stamens only have undergone this transformation it is possible to obtain seeds from double blossoms. The petals are removed in the same manner as the anthers from bisexual flowers, and the result is often effective, *i.e.*, fertile seeds are produced. Of course, the anthers from a single or semi-double flower supply the pollen; but where both stamens and pistil have undergone the transformation to petals, perpetuation by seeds is altogether out of the question. The reason is very patent—there are no organs of reproduction.

It will need a deal of patience and experience to be successful in the more delicate operations named, and the results will be very disappointing, for, as a rule, not one seed in a thousand or more will be an improvement on the original. Now-a-days the plant world has a tendency to go back to some earlier form.

These final remarks do not apply to the cultivation of pumpkins, melons, cucumbers, &c. The method of artificial fertilisation described will always ensure the best strains of them pure for years to come. To keep any choice strain in health and good heart a pollen-bearing bloom of the same strain should occasionally be introduced from another district; a plant or seed would be better if of the desired strain and also secured by artificial means. Such plants should be grown away from the main crop, and the anthers and pistils used for reproductive purposes carefully guarded from any chance of the pollen from an undesirable strain being conveyed to the stigma of the plants to be used for seed purposes.

The pollen in all cases contains the cells of life, and the ovaries in the pistilate blooms contain the cells of matter. It is the union of these two cells, that of life and that of matter, which produces fertile seeds.

Remember, in selecting for cross-pollenisation purposes, natural orders cannot be used to produce new or fresh orders; nor genus with genus to produce new genera. Species with species will sometimes produce hybrids, but the result is that these mules are seldom capable of being reproduced from seeds, and when such is the case, they die out after one or two generations of sickly vitality. Nevertheless, hybrids so produced can be

perpetuated by grafting, budding, &c. Hybrid annual seedlings seldom last for more than one season. Nature has always a tendency to revert to the original form from whence it sprung. In the ages gone by, whatever may have been the natural law as it regards the "development of species," the law now, in these later times, appears to have been repealed, not only in that of species, but even largely in that of varieties. Hybrids and varieties, both in the vegetable and animal kingdom, when removed from the fostering care of man degenerate gradually but surely to the prototypes from whence they came.

I notice that I have used the terms "natural orders" to produce new orders, "genus" to produce genera, &c.; this may not be equally clear to all readers. But let us take an illustration from every-day poultry-yard life. Everyone engaged in it knows it is utterly impossible to obtain a hybrid between a duck and a fowl, while a hybrid between a Muscovy and an Aylesbury, or a Pekin duck, are of frequent occurrence, but these mules so produced are never reproductive amongst themselves, because the Aylesbury is a different species to that of the Muscovy. Again, if an Aylesbury duck be crossed with a Rouen, the cross-bred descendants are as productive among themselves as their parents would be among members of their own family, because they are varieties of the same species. These same rules apply equally well to members of the plant world.

(*To be continued.*)

Bee Calendar.

ALBERT GALE.

SEPTEMBER.

In view of the range of climate of the Colony, what may be applicable to apiculture in one district may be quite out of season in another. It is therefore hoped that readers will understand that the advice given is general.

It is scarcely necessary to remind bee-keepers that the first consideration should be to keep the stocks strong. This matter should have been seen to during the final extraction of honey last season. During the winter months damp and mildew within the hive, cracks and cold draughts, enemies that have been overlooked when the bees were put up for the winter, and many other causes, may have weakened the stocks. During the middle of the warmest days in winter, and more especially as spring advances, dead bees may be seen on the alighting-board, and mortality is due chiefly, but not wholly, to the causes named. If it were possible to keep a record of vital statistics of bees, old age and starvation would show the highest score on the death-roll.

Along the coast districts spring forage is now becoming plentiful, and increasing in quantity as we go northwards. On the higher tablelands, especially southward, frosts and snow, still prevailing, will retard the spring operations considerably. In our warmer districts there will be more or less young brood in the hives, if the queens are up to the required standard; but not so in colder districts, where, outside the hives, deaths will be more numerous, and the stocks will be correspondingly weaker.

If forage be scarce the bees should be sparingly fed, so as to stimulate the early rearing of brood. Pure honey is by far the best and most easily procurable. But with pollen it is another thing. For this necessary article of bee-diet bees do not confine themselves wholly to the dust of flowers. In the cold district of Monaro I have known them to revel in horse-feed composed of a mixture of bran left in the feed-box, and go home laden therewith. This, to my mind, was evidence that there was plenty of honey in the hive, but a scarcity of pollen wherewith to prepare bee-bread for the coming brood.

There are many artificial substitutes for pollen—rice-flour, oatmeal, and pea-flour are amongst the best of them. There is not the slightest danger to the bees in giving them a fairly good supply of these during warm bright days. Place it in easy access. It must be taken indoors before sundown every day, and not put out in the morning till all dampness is gone. At no time should artificial pollen be permitted to become damp; it is sure to become mildewed. In that condition bees will refuse it, and if used it will produce dysentery. Treacle must not be used as a substitute for honey, nor wheat-flour for pollen. They act as a purgative, and thereby weaken the young brood.

If, during the winter months, all your frames have not been made and foundation comb has not been fixed to those required for summer use, no time should be lost in doing this work; as the season advances time will become more precious for other work in the apiary. See that all empty hives are clean and free from the larvæ of the bee-moth. Empty combs that were stored in the autumn should be fumigated a few days before using with sulphur-smoke. It is a good plan to fumigate empty combs two or three times during the winter months. If the stocks appear to be numerically weak, strengthen them by uniting the colonies. At this season of the year no colony will have sufficient brood-comb to admit of a weak colony being strengthened therefrom, but later in the season this can be done. If it is desired to largely increase the number of stocks, have placed in position all the empty hives you contemplate using. The outsides should be well painted. See that they are placed so that the combs will hang perfectly plumb.

Delay the inspection of stocks till later in the season, but if it be imperative to look through them now select a bright, sunny day, and the warmest part of it.

Towards the end of the month, in the warmer districts, queen-cells will be making an appearance. These should be cut out if it is desired to check early swarming. Nucleus hives should be prepared for queen-rearing, that is, if re-queening to any extent be contemplated. But queens are so cheap nowadays that it will be found better to purchase them from an accredited dealer.

Orchard Notes for September.

GEO. WATERS,
Hawkesbury Agricultural College.

GENERALLY speaking the winter has been a very mild one, and there is every prospect of an early spring and a good season for fruit in general, though I think a fairly severe winter does a certain amount of good, especially to stone fruit-trees, as it hardens the wood much better, and the trees get a more complete rest. A great deal of the success of the crop, especially in the prevention of the attacks of insects and fungus pests, depends upon the care given to them in the early spring.

If any spraying should yet be left undone it should be proceeded with at once before the trees start into leaf. As soon as the warm weather approaches, the spores of the many fungus pests start into growth and increase very rapidly.

As remarked in previous notes, the very best time to spray for fungus pests is just before the buds burst, and so as not to confuse any by too many washes, I can only reiterate that the Bordeaux mixture is the very best all-round fungicide. Nearly every grower is conversant with the method of making, and it has so often appeared in the *Gazette* that it need not be repeated here. Among insects, the peach aphis is one of the first to make its appearance. If allowed to go unchecked its results are very bad.

One thing must not be lost sight of when spraying, viz., cheapness in conjunction with effectiveness. About the cheapest effective spray for all insect-life is the resin-soda wash, viz., 4 lb. resin, 3 lb. washing-soda, boiled in 2 gallons water till dissolved, watching carefully to prevent boiling over. To use, add 35 gallons lukewarm water.

A new resin-wash that has been greatly used in South Australia, and has given excellent results, may be added here: Resin, 10 lb.; washing-soda, 5 lb.; fish oil, 1½ lb. (if not procurable, use 2 lb. of soft soap). Place soda in a boiler with sufficient water to allow it to boil freely; when dissolved, slowly add the finely-powdered resin; boil rapidly together for one hour, adding a little boiling water occasionally to prevent boiling over; then add 50 gallons of warm water. This may be weakened to one-half strength for use against Aphides.

NOTE.—This recipe has destroyed Aphides and such scales that are only partially armoured, such as Lecaniums; but for completely-armoured scales, such as Aspidiotii, 4 lb. caustic soda should be used in place of washing-soda, and the boiling should be continued for three hours.

I have given this so that any who wish may experiment.

The tobacco soft-soap wash has also been found very effectual for Aphides, and the only objection I have is its cost in comparison with the plain resin-wash. The method of preparation is as follows:—1 lb. tobacco or 3 lb. tobacco-waste, with 3 lb. soft soap, boiled in a closed vessel for one hour; then add 18 gallons water.

In vineyards where Black Spot or Oïdium is prevalent, if vines have not started into growth, no time should be lost in applying the sulphate of iron dressing, formula for which was given in last month's notes.

The apple enemy, Codling Moth, should be watched carefully, and fought by spraying at ten-day intervals,-after the fruit has set, with Paris green. The first application should be when the blossoms have fallen and the fruit set. A great deal of the success of spraying for Codling Moth depends upon having it done before the apple is sufficiently large that by its weight the calyx end turns downward, for when this occurs very few grains of the Paris green reach where they would be of use, viz., in the eye of the apple.

All pruning and spraying being completed, every attention should be given to cultivation of the orchard. Do not allow weeds to grow.

In young orchards, if any crops are intended to be planted, plant only those that you can cultivate between the rows, such as peas, beans, cabbages, potatoes, or even corn, if not planted too close to the young trees. Five, or even 6, feet is little enough to leave as margin between trees and rows of corn, though the dwarf varieties could be planted about 4 feet from them.

When the orchard soil is deficient in organic matter or nitrogen, green manuring should be practised. The best crops for this purpose are—first, cowpea; then vetches, or red clover where it will succeed. If we should have any showers during the month, the planting of citrus trees could be done safely.

Practical Vegetable and Flower Growing.

W. S. CAMPBELL.

Directions for the Month of September.

During this month the soil begins to absorb a considerable amount of heat, and becomes sufficiently warm for the growth of tender kinds of vegetables, and in most parts of the Colony frosts should be over.

Asparagus.—This vegetable may still be planted in cool districts, and it will take no harm even if the buds or shoots have started to grow. When planting, be very careful to spread out the roots so as to get the soil well in about them. Do not bunch the roots all together.

Arrowroot.—This is a plant which can be grown very easily in a warm situation in good soil. It should be planted about the end of the month.

Beans, French or Kidney.—This is one of the most useful vegetables we have, and one that can be grown without any difficulty. The seed should be sown in drills, 2 ft. 6 in. or more apart. Make the drills about 3 or not more than 4 inches deep, and drop the seeds along the bottom of the drills 4 to 5 inches apart. Cover with fine soil and firm down, but not too hard, with the back of a spade. If you beat the soil down hard it becomes caked, and the seedlings have difficulty in pushing through it.

Make periodical sowings so as not to have the bulk of the beans come in at one time.

If artificial manures are used, apply superphosphate of lime and potash, bone-dust, lime rubbish, gypsum or lime, as these substances will be found most advantageous for the growth of beans.

Bean Lima.—This may be treated in the same manner as the kidney bean. There are tall and dwarf-growing varieties, the former being the best. Sow the seeds a little wider apart than those of the French bean.

Beet, Red.—Sow a little seed in drills 1 foot to 18 inches apart, not deeper than 1 inch. It is better not to apply manure for this crop, but to use land that had been manured well for some previous crops.

Beet, Silver.—Manure well for this vegetable, in order to induce the growth of tender succulent leaves, for the leaves and not the roots are used. Sow a row or two.

Cabbage.—Sow a little seed in a seed-bed, and when the seedlings are strong enough they may be planted out.

Plant out from previous sowings if the plants are strong enough, in well-dunged land, in rows from 2 to 3 feet apart, according to variety, for some kinds attain much greater dimensions than others. The cabbage needs rich land; but if rank manure be used the cabbages are not unlikely to become ill-flavoured.

Cauliflower.—Plant out only in the coolest parts of the Colony.

Carrot.—Sow a few rows of the short as well as medium and long varieties. Do not use fresh manure. It would be better to take land that had been well manured for a previous crop. The best kind of soil for the carrot is a

fairly rich sandy loam, well drained. Sow in drills 1 foot to 18 inches apart. Keep weeds down, or else they are likely to destroy the young plants as they come up.

Celery.—Sow some seed in a small seed bed or box. Make the surface soil fine. Sow them and cover with fine soil. When the celery plants come up, thin them out if growing too close together. When about 3 to 4 inches or so in height, transplant to a well-prepared small bed about 4 inches apart. Here they will develop into strong young plants for again transplanting later on.

Cucumber.—Seed may be sown in the warm districts, or, if young cucumbers have been raised under protection, plant out. The soil should be well dug, well manured, and well drained.

Endive.—Seed may be sown in a warm corner where frost is not likely to attack it. When the seedlings are large enough to handle, transplant to a well-manured bed. Plant in rows about 15 inches apart, and 1 foot apart in the rows. When the plants have attained nearly full size, tie up the leaves of some of them to cause the hearts of the plants to become blanched.

Leek.—This vegetable needs rich soil and plenty of rich manure. The seed should be sown in a seed-bed, and when the plants have attained the height of 6 to 8 inches they may be transplanted. Plant deep in rows 18 inches apart, 9 inches from each other. Water frequently and apply liquid manure sometimes. The thick stems can be blanched by earthing them up.

Lettuce.—Sow a little seed in drills, where the plants are to grow, about 18 inches apart. When the seedlings come up, thin out to 1 foot apart. Use a good deal of rotten dung, and from time to time apply some liquid manure.

Melon, Rock.—Sow seed in all warm districts, as directed for cucumbers.

Melon, Water.—Sow seed as above.

Okra or Gumbo.—A vegetable producing a succulent, gumming, and mucilaginous pod, which is used in soups and stews. Best suited for warm climates. Sow seed in a box or seed-bed and afterwards transplant. Let the plants start about 2 feet apart in the bed

Onions.—Sow seed in drills in a well-prepared rich bed. Drain well and make the surface soil fine. Sow in drills from 6 inches to 2 feet apart, according to size of onion required. Cover the seeds very lightly with fine soil, and when the plants are an inch or two in height thin out. Keep the onions quite free from weeds.

Parsnip.—Sow a few rows as directed for carrots.

Peas.—Sow a few rows from time to time.

Pepper or Capsicum.—Sow a little seed in a pot or box, and afterwards transplant the seedlings.

Potato.—Drain some land, dig it deep, and manure well, and plant with good, sound, medium-sized potatoes, free from potato-moth and potato-scab, in rows 2 ft. 6 in. apart, or wider, at a depth of 6 or 7 inches, 1 foot from each other.

Pumpkins.—Sow a few seeds in well-prepared land.

Rhubarb.—Sow seed if plants are required. It is always as well to grow from seed, although the plants take a considerable time to come to maturity.

Tomato.—Sow seed in the open ground in all the warm districts, or transplant from seed-bed.

Turnip.—Sow a few rows in drills about 18 inches apart in well-manured ground.

Vegetable Marrow and Squashes.—Sow seed in the same manner as that recommended for cucumbers.

Flowers.

Plants of all kinds will now be making great progress, except in the cold parts of the Colony. Many spring flowers, such as narcissus, ranunculuses, daffodils, violets, anemones, pansies, hyacinths, a few tea-roses and others are generally well in bloom towards the end of the month.

The garden should be kept as free from weeds as possible, for unless checked they will soon overrun the place. If great care be taken it is not too late in the early part of the month to plant out evergreens, such as camellias, and tender or comparatively tender plants, like bouvardias. If dry weather sets in they should be protected and watered occasionally, and until they have become thoroughly established. Old plants of bouvardias may be pruned back hard to induce abundant fresh young growth, which will produce bloom in abundance. Sow seeds of tender annuals and perennials for transplanting. If any seedlings have been raised plant them out freely. Cuttings of chrysanthemums should be taken and struck, for these will make better plants than the old clumps, which may be thrown away when the cuttings have taken root.

General Notes.

Trial of Cotton at the Pera Bore Farm.

Mr. C. H. Gorman, Manager of the Pera Bore Farm, reports as follows with respect to the trial of cotton at that place:—

Seeds of a variety unnamed and sent from the Department were planted on the 24th November, 1896. The land chosen was of a sandy nature, with a heavy subsoil, and should have been trenched. A small plot only was planted, chiefly on account of the lateness of the season, the better time for planting being August or September. After being ploughed to a depth of 5 inches, the land was harrowed and rolled. The seed was planted 1 foot apart, in rows 4 feet distant, but for future planting, and under irrigation, I would recommend 3 feet apart in the rows. Almost immediately after planting a good shower of rain fell, which saved one irrigation, the seed germinating in twenty-two days. The plants grew very rapidly, and when 1 foot high were irrigated for the first time. They were given a thorough soaking, and cultivated to a depth of 3 inches with a Planet Junr. 1-horse cultivator. As soon as dry enough to permit a horse walking on the ground, cultivation was carried on at intervals of three or four weeks, and on the 1st April a small picking of cotton was made. In some cases I thinned out the pods, as in fruit-thinning. To my mind this is one of the most important points in cultivation. The difference in the cotton from pods on thinned plants and unthinned was very marked. When thinning, I noticed some plants were badly attacked with a green borer, the like of which I have never seen before. Unfortunately, I was unable to get it in its young state. The plants that were affected I dusted with wood-ashes and Paris green. The first picking of the cotton was not nearly as good as later, the staple being much shorter. Picking operations can be carried on every four days, but the process is very slow, and this would, of course, have to be taken into consideration in the planting of any large area. During the coming year I intend extending operations so that larger tests may be carried out. That cotton can be produced of good marketable quality I am convinced, and if we can dispose of it locally the cotton industry in the west ought not be long in establishing itself. We have everything in our favour—climate, soil, and water.

A New Sugar-cane in the French West Indies.

We are indebted to the *London Board of Trade Journal* for the following account of a new sugar-cane in the French West Indies:—

"In a report to the Foreign Office, Mr. Gustave Borde, Her Majesty's Acting Consul at Martinique, states that the disappointments that the planters were wont to experience in regard to the quantity of sugar-canes reaped, have greatly diminished since the introduction on the sugar plantations of a species of sugar-cane, known locally as the "Cristalline," which

is to be met with in Saint Lucia as the "Caledonian Queen." It is generally believed that this new plant is a valuable acquisition, and will be most useful to agriculture. When young it grows very fast, being the reverse of the sugar-cane plants now under cultivation, the growth of which is slow. By its rapid growth the new plant covers ground quickly, and checks the development of the grass that would otherwise impede the spreading of its leaves. It resists more easily the irregularities of the seasons, and is able to sustain very long droughts. The "shot borer" seems to shun its company, or rather, if a few plants are attacked, their vegetation is not in any way impeded. Judging from the experiments tried during the past year particularly, this species of sugar-cane is as rich in saccharine matter as all the others that have been hitherto cultivated. Hence, wherever the ordinary plant dies out, the planters endeavour to introduce the "Cristalline," the good qualities of which were conspicuously manifested in many localities very seriously affected by the fungus or other cane disease. For many years chemists have been endeavouring to find out the cause of the disease, and have tried various methods of fighting it, but invariably failed."—*Foreign Office Annual Series No.* 1,897.

Arrangements will probably be made to procure this variety for the Richmond River Experiment Farm, where successful experiments in propagation of new varieties of sugar-cane for distribution to our cane-growers have been successfully conducted for several years.

Lucerne Hay for Milch Cows.

Experiments prove it to increase yield, but decrease the richness of Milk.

We have received from a number of dairy farmers inquiries as to the effects of lucerne hay on the quality and quantity of milk. The New York Experiment Station, in its Bulletin No. 80, publishes the results of trials covering several years in feeding lucerne hay to eight to fourteen milch cows, in comparison with other feeds such as oat-and-pea forage, "mixed hay," maize silage. The outcome is stated thus:—

"When lucerne forage was substituted for some other food or the amount of lucerne in the ration increased, there followed in ten instances a decrease in the cost of the milk, in two instances a very slight increase in cost, and in two instances the cost of the milk was practically the same. There was an increase in the yield of milk in seven instances, a decrease in four instances of about what might normally be expected to occur without change of food, and little change in yield in three instances.

"When the change was from a ration containing lucerne to one containing less or no lucerne, there followed an increase in the cost of milk in ten instances, and there was about the same cost once. There was a decrease of the milk yield in nine instances, and an increase of the milk yield in two.

"When lucerne was substituted for other foods in the ration or the amount of lucerne increased, there followed a decrease in the cost of butter fat in seven instances, and an increase of the cost in six instances. There was an increase of the amount of fat in six instances, a decrease in five instances, and little change in amount twice.

"When the change was from a ration containing lucerne to one containing less or none, there followed an increase in the cost of fat in nine instances, a decrease in cost once, and there was about the same cost twice. There was an increase of the amount of fat in three instances, a decrease in three, and about the same amount of fat in five.

"When the change in the ration was to more lucerne, or to lucerne in place of some other food, there followed a decrease in per cent. of fat in milk in six instances, an increase in three, and little change in per cent. in four instances. When changed from a ration containing lucerne to one containing less or none, there followed an increase in fat in six instances and a decrease in five.

"There has been usually an increase in milk yield accompanying the use of lucerne, although there was often at the same time a decrease in the per cent. of fat. With lucerne forage rated at the same cost as other forage, there was generally a decrease in the cost of milk when the lucerne was fed, and not much change in the cost of the fat produced.

"Maize forage, fully matured, in the results accompanying its use, has compared most favourably with lucerne; but except in the form of silage, it is only available for a short time in the autumn before frost."

Boiling-down Refuse.

At the Agricultural Conference Mr. W. Bowring, of Wentworth, raised a question as to the best means of turning to the best manurial account the coarse bones and refuse from boiling-down works.

Mr. J. L. Thompson, in reference to this subject, said that he had used hundreds of tons of such refuse. The proper way to treat it was to compost the stuff for eighteen months, and at the end of that time, if you gave it a knock with the back of a shovel, it would break up and become very friable. He regarded boiling-down refuse as a good, pure, and effective manure.

Successful Melon Culture.

Watermelons are excessive feeders, and many fail in attempting to grow them because they do not furnish sufficient plant food to supply the necessary strength for vigorous vines and fine fruit. Not infrequently watermelon vines turn yellow and die when they should be just in their prime, simply from plant starvation.

I prepare the ground as for corn. Lay off in rows 12 feet apart each way. I dig a hole about $1\frac{1}{2}$ feet deep and perhaps three feet in diameter. In the bottom of this I put a peck or more of good stable manure, tramping it lightly. Next put in a layer of soil, and follow with a layer made up of equal parts of soil and fine rich manure thoroughly mixed, and lastly, where the seeds are to be placed, another layer of pure soil. Sow seeds thickly and cover about one inch. When the second or third leaf shows, thin out to two or three plants in the hill. If exceptionally large melons, regular "prize takers," are desired, thin to but one plant in the hill. I cultivate about as I do corn, hoeing each hill after entire patch is ploughed. If very dry, cultivate often, particularly about the hills. It is some trouble to thus prepare the ground, but it more than pays in the size, number, and quality of melons produced, also in the increased length of time that the vines are in bearing, as they remain green and in good condition until killed by frost. —Clara S. Everts (*American Agriculturist*).

Replies to Correspondents.

Permanent and Temporary Pastures.

THE attention of the many correspondents who have asked for advice as to the laying down of permanent and temporary pastures is directed to the following extracts from a paper read at the Agricultural Conference by Mr. Geo. Valder:—

"In past years the farmer in most instances had a farm sufficiently extensive in area to allow of his putting aside a large portion of it for grazing purposes; but now that it is becoming more and more difficult every day to obtain large farms, he finds that often his pasture land is not large enough to carry his stock, or, to speak more correctly, does not grow sufficient grass to feed them. The time is therefore coming when he will have to pay more attention to the laying down of permanent and temporary pastures. As a proof of this I may say that the number of letters received by the Department regarding this question has increased very largely during the past year, and it is mainly in answer to these that I have written this paper.

"Again, dairy-farming is largely on the increase in this Colony. Large quantities of dairy-produce are already being exported, but nothing like the amount which we should export. It is well-known that one of the strongest factors in dairying is good grass and plenty of it; but here, again, unless steps are taken to improve our pastures we cannot make dairying as profitable as it should be. As with most of our sheep-stations so with our dairy-farms—they are fast receding in the value of the herbage through overstocking: good grasses are being replaced by worthless ones or by weeds.

"When a farmer in the warmer parts of the Colony sends in a letter, asking what is the best thing to sow on land which he is preparing for pasture, he invariably gets the reply: On suitable land sow lucerne, and whenever possible collect the seeds of the best native grasses in your district, and sow them on cultivated land.

"Now, as to the first, lucerne is undoubtedly a wonderful fodder-plant. Great strides have been made in its cultivation, and I think I can say that to-day it is regarded by most pastoralists as the most wonderful fodder-plant yet introduced; and, although such strides have been made with lucerne, I consider that its capabilities are nothing like known. There are many soils which are now regarded as unsuitable for lucerne-growing, but under certain conditions, *i.e.*, better systems of cultivation, they would often pay well; and I expect that before long lucerne will be extensively cultivated on lands which were at one time regarded as totally unfit for such a crop.

"But, in spite of the great value of lucerne, it is gradually being felt that something else is wanted. Several pastoralists have reported to me that they often found sheep did not thrive as well as expected when fed entirely on lucerne. This result is due to the well-known fact that all animals do better when their feed is composed of a number of plants than when fed on

a crop of one kind only. It is generally admitted that plants of the grass family are the most suitable for feeding with leguminous plants such as lucerne, and I will therefore now deal with them.

"At Wagga I tried a very large number of grasses, both native and introduced, and of all these only a few gave good results, and in every instance they were native ones. The Mitchell grasses *Astrebla triticoides* and *A. pectinata*) and the Blue-grasses (*Andropogon sericeus* and *A. pertusus*) seemed to be specially suited for cultivation. It was noticed that under cultivation these grasses improved in every way—not only did the plants grow much higher, but they produced leaves plentifully right up the flowering stalks, thus giving promise of being first-class species for hay-making. It is only reasonable to expect that these grasses will improve very much under proper cultivation, and the results obtained at Wagga fully convinced me that such will be the case.

"The only trouble at present seems to be the collection of the seed; it must be acknowledged that this is rather a difficult matter. In the first place, the plants of a grass are often very scattered, and therefore the collection of seed is rather a tedious work. Secondly, some of our native grasses, for some reason, do not mature a large percentage of their seed, notably Kangaroo-grass. And, thirdly, few people seem able to judge when the seeds of our native grasses are ready for collecting. As an instance of this, I may state that in 1896 I received 1,400 packets of so-called grass-seeds, which had been collected for me by men connected with the various branches of our Department. Of these 1,400 packets, only thirty-six contained properly-matured seed, the others being merely empty glumes, flower-heads, or seeds of plants which were not true grasses. It can, therefore, be well understood how it is that so few farmers respond to the advice given by the Department, viz., collect the seeds of the best native grasses in your district, and sow them.

"No doubt some few farmers will succeed in bringing many of our native grasses into cultivation, but I hope that before long the Department will be able to lead the way by not only cultivating these grasses in large quantities, but also in being able to sell good seed from the portions they cultivate, so that the farmer may get a good start.

"The best way to propagate grasses and salt-bush on a large scale is to enclose small areas, and allow the plants to run to seed. It would be necessary to shut up for a certain times the paddocks surrounding the 'seeding plots.' Another way is to subdivide into small paddocks, and let the grasses have a chance to get started before the stock are turned in. There is no doubt that Prairie-grass will often succeed in the drier parts of the South Coasts where Perennial Rye and Cocksfoot will not do well. It is no good, however, on the red soil, of which the Riverina is mostly composed."

Advice to Intending Fruit-growers.

MR. W. J. BALDWIN, of Freeman's Reach, and many other correspondents, have asked for information on various points of the commercial aspect of fruit-growing. In reply, the Fruit Expert, Mr. W. J. Allen, has furnished the following notes:—

"I think that the intending planter cannot easily go astray now in choosing the proper kinds of fruit-trees to plant in his district, if he will but spend a week or ten days in visiting the various orchards in that district, and ascertaining for himself which fruit-trees grow and bear the best crops in that particular locality, then only choose the very best varieties of those especial

fruits and such as have proved themselves most profitable. Next, he must be careful in the selection of trees, and insist on getting them true to name.

"If the orchardist is living close to a city where he can dispose readily of his fruits fresh, it will be wise to plant fruits which will come in in rotation for this purpose; and in planting an orchard of this kind he is justified in raising numerous varieties, so that he may have a succession of fruits; and if he choose only the best of these particular kinds, packs them neatly, and so as to present a good appearance, he cannot fail to reap his reward in being always able to command good prices. Thus with well-grown and good-flavoured fruit, of good size, and properly graded and packed, there need be no difficulty in finding a market; what is spoiling our markets being the quantity of inferior fruits which are placed upon them, the grower being only too glad to find a sale for it at any price.

"If the fruit-grower would only take the trouble to have his soil analysed before he begins to plant, he would be in a position to know whether it was deficient in any of the chemicals necessary to produce the best quality of those fruits he intends planting, and, if so, to apply such manures as will supply this deficiency. This would save him much worry and speculation as to why his fruit was not up to the mark either for size or quality; and given such manures and keeping the orchard well worked—never allowing the weeds to grow, keeping the trees well pruned, and spraying them well as often as is necessary,—the orchard will soon be sturdy and healthy, and ready to begin bearing good crops of such fruits as will bring the highest prices when placed upon the market.

"In this connection, however, I do not recommend the planter going in too heavily for fruits which are only good for dessert. There are now many varieties which, while they combine all the qualities of a fine dessert fruit, are also suitable for either canning or drying.

"Thus, for the orchardist who is a good way back from either the railway or city, I would advise growing only the hardier class of fruits—such as will keep well and are suitable for export, or such as are of the best kinds for drying purposes.

"Most trees begin to bear at three years old, but do not return fair crops until five years old; they should increase in size and productiveness until they are at least fifteen, excepting the vine and a few other fruits which are not particularly long-lived, and which come into full bearing at seven or eight years old.

"I could not very well give the estimated number of cases per tree, as that would depend entirely on the attention which the orchard received in the way of thorough cultivation, pruning, spraying, and manuring, and last, but not least, the locality. There are many soils and localities where fruit-growing would never pay, while, on the other hand, there are thousands of acres in this Colony where the very best fruits could be grown.

"Let me, therefore, again recommend the man who intends going in for fruit-growing to use the same intelligence as he would were it a matter of setting up in any other business or profession—bring his brains as well as his hands into the work, choose only the best soils, and have not only the surface soil but also the subsoil analysed, and if the chemist does not give him a favourable report, either give up the idea of going heavily in for fruit-growing, and just plant a few trees for a test, or, if he has decided on making a business of fruit-growing, move into one of the best districts he can find, where he will not be under the necessity of experimenting, but where it has been proven that fruits grow to perfection.

"Every year there are thousands of pounds spent in importing both dried and citrus fruits into this Colony, while we have both the soil and climate to produce not only enough for our own requirements, but sufficient to export in large quantities. For dried and citrus fruits we have a good market in Tasmania and New Zealand, whilst the English market during two or three months of the year would take thousands of cases of best oranges and lemons."

Citrons, Pomelos, and Seville Oranges for Preserving.

MESSRS. CARR, BROS., AND GURIN, of Galston, inquire for information *re* the cultivation of citrons, pomelos, and Seville oranges, for preserving purposes. The Fruit Expert, Mr. W. J. Allen, says:—

"These fruits receive in every way the same cultivation and require the same soil as the orange and lemon. After choosing a good soil, plough properly and prepare same for planting. And in this connection I might say that where irrigation is to be practised I would prefer a red sandy loam, which being warm the trees make a more vigorous growth, and the soil is easily worked; but where the orchardist depends on the rainfall, I think some of the darker soils would be more preferable, as retaining the moisture better.

"In planting out the trees the utmost care must be taken not to allow the roots to become exposed to either the sun or air, as the least exposure is very injurious—in fact, if one is not too far from the nursery it would pay to have all orange-trees packed in damp soil in transporting them from the nursery to the proposed orchard, and then only take out one at a time and plant immediately, so that the roots will not be exposed for more than a few seconds at the most. After planting, cut the head well back, and protect the stem until the top is large enough to shade from the hot sun. From this time on the orchard should receive the best of care and cultivation, and if a little manure is applied it will well repay the outlay, as the trees will make a more vigorous and quick growth, and will commence to yield crops several years before the orchard which receives little or no attention. There are nine months of the year when the orchards should receive the best cultivation. These are from 1st July to 1st of April. If desirable, the soil may be given a rest during the months of April, May, and June, and any weeds which may grow during these three months may be ploughed under and serve as fertilizer. However, in some of the warm districts where heavy rainfalls are frequent it may be found impracticable to stop the cultivating during these three months, as the grass and weeds would make such a growth as to render ploughing a most difficult matter. It will repay well to mulch around the tree with either well-rotted manure or shale, and to loosen, with a fork-hoe, that portion of the soil where the cultivation cannot reach; this tends to retain the moisture.

"I would not, however, recommend planting too largely of pomelos or citrons, as the demand, so far, is not very great, and the market could be easily overstocked. On the other hand, the Seville orange will always be in fair demand for marmalade."

Figs.

IN reply to a number of inquiries that have been made with respect to the cultivation of figs, and the best varieties for drying purposes, the Fruit Expert, Mr. W. J. Allen, states:—

"I consider the fig-tree the easiest tree to grow, and if planted in ordinarily good soil and given sufficient moisture, it will in three years time have grown

to a good-sized tree and ready to start bearing good fruit, the crops increasing as the tree becomes older.

"The varieties which have proved to be the best for drying in these Colonies are the White Adriatic and the White Genoa—the preference, however, being given to the former, as in many cases the bloom end of the White Genoa does not develop properly, and, in consequence, when the fruit is dried that portion is tasteless and dry.

"So far as I am aware, the fertilization of the Smyrna fig is still in the experimental stage in the Colonies, and without proper fertilization it will not fruit. This, when it can be produced in sufficient quantity, will prove the best drying fig.

"It must be borne in mind that the fig must not be picked until perfectly ripe, or else it will be quite useless. Also that, like other fruit trees, it repays best when given good cultivation.

"I propose writing an article on fruit-drying very shortly, and will treat then on the process of drying the fig."

Scanty-bearing Pear and Cherry Trees.

Mr. James Walsh, of Beneree, Forest Reefs, writes:—"I have several pear-trees from nine to twelve years old. They bear very scanty, and some do not bear at all. Also some White Heart cherry-trees which bear well on the north-east side, while on the south-east side the fruit is very small and worthless."

Referring to the pear-trees, the Fruit Expert, Mr. W. J. Allen, would recommend root-pruning in the winter or early spring, cutting a semi-circular trench 2½ feet deep halfway around the tree, and at a distance from 4 to 6 feet, according to the size of the tree. The following year do likewise, on the opposite side of the tree, and if this root-pruning has not the desired effect, try a light pruning when the tree is in bloom.

For the cherry-trees, Mr. Allen would recommend a good dressing of manure with thorough cultivation, so that the land will hold as much moisture as possible. In districts where irrigation is not practised it is always as well to get the ploughing done early, so that the soil will take in as much moisture as possible.

Mr. Walsh adds that he grafted some apple-trees with Winter Majetins. They came on well till February, when the grafts became worthless and perished. The Fruit Expert is of opinion that the very dry season we had is responsible for these young apple-trees dying off.

Swollen Teats and Bad Milk.

Mr. John Bate, of the Pines, Tilba Tilba, brought under notice an affection of the udder, which he described as follows:—"The first symptoms generally appear by the quarter or quarters of the udder becoming very hard and swollen, from which, for the first one or two milkings, very little milk can be obtained. The little milk that is drawn has a thin, watery look. After this the swelling may decrease, but the milk will have small fragments of matter of a yellow, curd-like appearance mixed through it, and in some cases this bad milk so increases that it becomes a thick, clotted matter. As a rule, despite careful milking, when the complaint reaches this stage it results in the loss of the parts affected. I have noticed, however, a number of cases in which cows have so far recovered that the milk from the teats in question has become quite pure and good again, but seldom or never do they regain the same strength as the teats not affected."

The Chief Government Veterinarian, Mr. E. Stanley, reports: "The condition described is owing to inflammation of the quarter of the udder, and may arise from injury or from negligent 'drying off.' I would advise hot fomentations and drawing of the quarter three or four times daily; the affected part to be rubbed with oil or arnica lotion."

Ants and the Black Aphis.

Mr. J. Sheather, of Stockingbal, in a recent communication inquires: "Have small black ants anything to do with the appearance of the black aphis which smother the shoots of peach and apricot trees as soon as the buds burst? People tell me that the ants go up the trees to eat the aphides. I have watched the ants for a good many seasons, and as far as I can see, they do not eat the aphis. I tried preventing the ants from getting up the trees, with the result that my trees are perfectly clean."

The Entomologist, Mr. W. W. Froggatt, states that Mr. Sheather's observations are correct; the black ants do not eat the aphis, but climb up the tree to get the "honey-dew, exuded from two glands upon the back of the little aphis. It is this honey-dew that, falling upon the foliage of the infested trees, causes them to become covered with black fumagine, a fungoid growth that grows upon the sugary secretion.

The ants really protect the aphides, as through their presence insects that would feed upon them are kept away. Some species of ants build covered galleries over aphides and scale insects to protect them, and the aphides have been described in popular works upon natural history as "Ant cows."

Scent from Sweet-briar.

Mr. Joseph Hanson, of Armidale, asks if it will pay to make scent from sweet-briar. Mr. Dunnicliff, who had charge of some experiments that were conducted some time ago in connection with the extraction of essential oils, considers that it would be useless to attempt the manufacture of scent from the sweet-briar. The quantity of essential oil in the blooms is so very limited that we have no appliances or process by which it could be profitably extracted. The perfumes offered as "Sweet-briar" are, so far as Mr. Dunnicliff is aware, merely combinations of other extracts in imitation.

Eradication of Scrub.

Mr. W. Court, of Breeza, Mr. F. Beatson, Secretary of the Wollongong Agricultural Society, and other correspondents have asked for information concerning effective means of checking the spread of scrub and noxious weeds. The question of a simple, cheap, expeditious, and effective method of eradicating scrubs is a difficult problem that has occupied the attention of the Forest Department for a considerable time past. Many notes have been taken, and some experiments are now in progress; but nothing sufficiently definite on the subject has been, so far, acquired to warrant public direction in the matter. When any useful information can be afforded, full details will be published in this *Gazette*.

Mr. Beatson referred specially to Paddy's lucerne, on which an illustrated article will be found in the *Gazette* for August, 1894. Some further notes on the pest were published in the April, 1895, number of the *Gazette*, page 229. The natural disappearance of some weeds is referred to at page 155, *Gazette* of March, 1895. In 1891 some experiments in the eradication of Paddy's lucerne in the North Coast District, with a mechanical weed-extractor, which is figured and described in the *Gazette* for 1891, page 814.

Green Manuring.

Mr. H. P. Davenport, of Barber's Creek, writes: "I should like to know the best crop to grow for green manuring, where clovers will not grow."

Mr. Valder considers that cow-pea, sown in spring (September or October), is by far the best crop for green manuring. For autumn sowing, tares, Tangier pea, and rape are recommended.

Grass Hay.

Mr. H. S. Wright, of Iffley, Rydal, mentions that rye-grass, cock's-foot, prairie-grass, and white clover, sown in September, and cut for hay in January, yielded very good results.

Nut-grass.

Mr. M. Waddell, of Ellisland, Singleton, asks if anything can be done to eradicate the nut-grass, which plays havoc among crops in his district.

Mr. Dunnicliff, Manager of the Bathurst Experiment Farm, who has spent a lot of time in the Hunter River District, says the most effective way to keep this pest in check—for it is almost impossible to destroy it—is frequent ploughing and stirring of the soil in winter-time, so as to expose the roots or bulbs to frosts as much as possible.

Most suitable Trees for Clayey Soil.

Mr. F. W. J. Ackhurst, of Wyee, asks: "What fruit-trees will do best in clayey soil?"

The Fruit Expert, Mr. W. J. Allen, is of opinion that pear-trees are most suitable. Apples, apricots, and lemons also do fairly well in clay; but of of course good results cannot be obtained in such soils without adequate drainage.

The Effect of Forest Destruction upon Rainfall.

Several correspondents have raised questions as to the effect of ringbarking and clearing upon rainfall.

The Government Astronomer, Mr. H. C. Russell, reports: The destruction of forests in New South Wales from the time that ringbarking was introduced, and for some fifteen or twenty years after, would seem to have been more rapid than the destruction of any other forest in the world, and during that period the rainfall gradually increased. There is clear proof that the rainfall in this part of the world did not get less as the trees disappeared, and in other countries where the question has been fully investigated, it has been found that the rain comes whether there be trees or not.

Insect Specimens.

A number of correspondents have asked for advice as to the most effective means of getting rid of various insect pests, which are described in a casual sort of way as "a little green fly," "a brown bug," and so on. It would be much more satisfactory for all concerned if such inquiries were accompanied by specimens of the insects, and the fruit, leaves, or wood affected. All that it is necessary to do is to put the consignment in a little baking-powder or similar tin box, perforated, and paste on one of the free-postage, addressed labels to be found in each copy of the *Gazette*. If a cardboard box is used or the insects are wrapped in paper, there is considerable risk of injury or escape.

AGRICULTURAL SOCIETIES' SHOWS, 1897.

Society.	Secretary.	Date.
Dapto A. and H. Society	A. B. Chippendall	Jan. 6, 7
Albion Park A. and H. Association	H. Fryer	„ 13, 14
Gosford A. and H. Association	W. McIntyre	„ 29, 30
Wollongong A. and H. Society	J. A. Beatson	Feb. 3, 4
Cobargo A., P., and H. Society	T. Kennedy	„ 16, 17
Ulladulla P. and A. Society	C. A. Cork	„ 16, 17
Berrigan A. and H. Society	R. Drummond	„ 17
Riverina P. and A. Society (Cereal)	W. Elliott	„ ——
Manning R. (Taree) A. and H. Association	H. Plummer	„ 18, 19
Lithgow A., H., and P. Society	J. Asher	„ 18, 19
Robertson Agricultural Society	R. J. Ferguson	Mar. 2, 3
Bega A., P., and H. Society	J. Underhill	„ 3, 4
Southern New England (Uralla) P. and A. Association	Jas. Leece	„ 9, 10
Tumbarumba P. and A. Society	W. Willans	„ 9, 10
Tenterfield Intercolonial P., A., and M. Society	F. W. Hoskin	„ 10, 11, 12
Coonabarabran P. and A. Association	E. May-Steers	„ 11
Oberon A., H., and P. Association	A. Gale	„ 11, 12
Berrima District (Moss Vale) A., H., and I. Society	J. Yeo	„ 11, 12, 13
Cobargo A., P., and H. Society	T. Kennedy	„ 16, 17
Crookwell P. and A. Association	W. P. Levey	„ 18, 19
Lismore A. and I. Society	T. M. Hewitt	„ 18, 19
Walcha P. and A.	F. Townsend	„ 23, 24
Cudal A. and P. Society	C. Schramme	„ 24, 25
Blayney A. and P. Association	J. Clements	April 1, 2
Mudgee A., P., H., and I. Association	J. Cox	„ 6, 7
Liverpool Plains (Tamworth) P., A., & H. Association	A. M'Leod	„ 6, 7, 8
Warialda P. and A. Association	W. B. Geddes	„ 7, 8
Williams River A. and H. Association	W. Bennett	„ 7, 8
Cooma P. and A. Society	D. C. Pearson	„ 7, 8
Orange A. and P. Association	W. Tanner	„ 7, 8, 9
Gulgong P. and A. Association	C. E. Hilton	„ 13, 14
Queanbeyan P. and A. Association	W. D. Wright	„ 13, 14
Royal Agricultural Society	F. Webster	„ 14-20
Moree P. and A. Society	S. L. Cohen	„ 21, 22
Clarence P. and A. Society (Grafton)	J. Wilcox	„ 27, 28
Bathurst P. and A. Society	W. G. Thompson	„ 28, 29, 30
Hunter River (West Maitland) A. and H. Association	W. C. Quinton	„ 28, 29, 30
Hay Hortic. Society	J. Johnston	May 5
Namoi P. and A. Association (Narrabri)	J. Riddle	„ 5, 6
Hawkesbury District Agricul. Association (Richmond)	C. S. Guest	„ 6, 7, 8
Upper Manning A. and H. Society	W. Dimond	„ 12, 13
Wellington P. and A. Society	R. Porter	„ 13, 14
Upper Hunter P. and A. (Muswellbrook)	J. C. Luscombe.	„ 19, 20, 21
Nyngan and District	E. H. Prince	June 1, 2
Brewarrina P. and A. Association	H. L. Cathie	„ 7, 8
Cobar P. and A. Association	W. Redford	„ 9, 10
Deniliquin P. and A. Society	H. J. Wooldridge	July 13, 14
Hay P. and A. Association	Chas. Hidgcock.	„ 22, 23
Riverina P. and A. Society (Jerilderie)	W. Elliott	„ 27, 28
Condobolin P. and A. Association	H. W. Grey Innes.	„ 28, 29
Lachlan P. and A. Association (Hillston)	Thos. Cadell	„ 30
Gunnedah P., A., and H. Association	J. H. King	Aug. 3, 4
Forbes P., A., and H. Association	F. Street	„ 5, 6
Corowa P., A., and H. Society	E. L. Archer	„ 19, 20
Cootamundra A., P., H., and I. Association	T. Williams	„ 25, 26
Grenfell P., A., H., and I. Association	G. Cousins	„ 25, 26
Northern Agricultural Association	C. Poppenhagen	Sept. 1, 2
Murrumbidgee P. and A. Association (Wagga)	P. W. Lorimer	„ 1, 2

Society.	Secretary.	Date.
Burrawong P. and A. Association (Young)	C. Wright ...	,, 1, 2
Manildra Agricultural Society ... ... (Ploughing Match and Horse Parade.)	G. W. Griffiths..	,, 8
Albury and Border P., A., and H. Society	Geo. E. Mackay	,, 8, 9
Murrumburrah P., A., and I. Association	Miles Murphy...	,, 8, 9
Yass P. and A. Association	Thos. Bernard...	,, 9, 10
Wallsend and Plattsburg A. H. P. P. and C. Society ...	G. Gilmour ...	,, 9, 10, 11
Junee P., A., and I. Association	T. C. Humphrys	,, 15, 16
Burrowa P., A., and H. Association	J. H. Clifton ...	,, 16, 17
Cowra P., A., and H. Association	Fred. King ...	,, 22, 23
Temora P., A., H., and I. Association	W. H. Tubman.	,, 22, 23
Moama A. and P. Association	C. L. Blair ...	,, 29
Narrandera P. and A. Association	J. F. Willans ...	Oct. 6, 7
Berry Agricultural Association	A. J. Colley ...	Nov. 24, 25, 26

Dapto A. and H. Society	A. B. Chippendall	Jan. 12, 13
Albion Park A. and H. Association	H. Fryer ...	,, 19, 20
Kiama A. Association	J. Somerville ...	,, 25, 26
Alstonville Agricultural Society	H. R. Elvery ...	Feb. 1, 2
Wollongong A., H., and I. Association	J. A. Beatson ...	,, 2, 3
Robertson Agricultural Society	R. G. Ferguson..	,, 8, 9
Shoalhaven A. and H. Association	R. C. Leeming...	,, 10, 11
Manning River A. and H. Association (Taree)	H. Plummer ...	,, 10, 11
Moruya A. and P. Society...	John Jeffery ...	,, 11, 12
Ulladulla A. and H. Association (Milton)	C. A. Cork ...	,, 16, 17
Tumut A. and P. Association	B. Clayton ...	,, 26, 27
Southern New England P. and A. Association (Uralla)	J. D. Leece ...	Mar. 1, 2
Bega A., P., and H. Society	J. Underhill ...	,, 2, 3
Upper Hunter (Muswellbrook) P. and A. Association...	J. C. Luscombe.	,, 2, 3, 4
Bombala Exhn. Society	R. H. Cook ...	,, 8, 9, 10
Tenterfield Intercolonial P., A., and M. Society ...	F. W. Hoskin...	,, 9, 10, 11
Cudal A. and P. Society	C. Schramme ...	,, 10, 11
Crookwell P. and A. Association	M. P. Levy ...	,, 10, 11
Inverell P. and A. Association	I. McGregor ...	,, 10, 11, 12
Berrima District (Moss Vale) A. H. and I. Society ...	J. Yeo	,, 10, 11, 12
Armidale and Glen Innes Combined New England District Show at Armidale.	J. Allingham ...	,, 16, 17, 18
Cumnock P. and A. Association	Thos. Howard...	,, 17
Blayney A. and P. Association	G. Pile, junr. (acting).	,, 17, 18
Goulburn A., P., and H. Society	J. J. Roberts ...	,, 17, 18
Walcha P. and A. Association	F. Townshend...	,, 22, 23
Namoi P., A., and H. Association	J. Riddle ...	,, 23, 24
Central Richmond (Coraki)	D. Cameron ...	,, 24, 25
Camden A., H., and I. Society	W. R. Cowper...	,, 23, 24, 25
Bathurst A., H., and P. Association	W. G. Thompson	,, 23, 24, 25
Macleay A., H., and I. Association	J. M'Maugh ...	,, 30, 31, and April 1.
Orange A. and P. Association	W. Tanner, junr.	,, 30, 31, April 1
Molong A. and P. Association	P. F. A. Kinna..	April 5, 6
Warialda P. and A. Association	W. B. Geddes...	,, 6, 7
Royal Agricultural Society of N.S.W.	F. Webster ...	,, 6–12
Richmond River A., H., and P. Society (Casino) ...	Jas. T. Tandy...	,, 14, 15
Hawkesbury District Agricultural Association	C. S. Guest ...	May ——

Secretaries of Societies are asked to forward dates of forthcoming Shows as soon as decided.

[Six plates.]

Triraphis microdon, Benth.

Useful Australian Plants.

BY J. H. MAIDEN,
Government Botanist and Director of the Botanic Gardens, Sydney.

No. 43.—*Triraphis microdon*, Benth.

Botanical Name.—Microdon, Greek—*micros*, small; *odous*, *odontos*, a tooth—the three principal nerves of the flowering glume being produced into short terminal points or small teeth.

Synonym.—Triodia microdon, F.v.M., in Mueller's *Census*. There seems little doubt that this species should be referred to *Triodia* rather than to *Triraphis*, a view I should adopt were it not for the convenience of as close adherence as possible at present to the nomenclature of the *Flora Australiensis*.

Botanical description (*B. Fl.*, vii, 605).—An erect glabrous grass of 2 or 3 ft.

Leaves narrow, flat or convolute.

Panicle very loose, with long capillary branches, bearing each one to three large flat spikelets, on capillary pedicels, at first erect, at length pendulous.

Spikelets, 10 to 14 flowered, ¾ to 1 in. long, the rhachis with a tuft of short hairs under each flowering glume.

Outer empty glumes narrow, acute, keeled, with or without a faint nerve on each side.

Flowering glumes, distant from each other, about 4 lines long, rigid, with five very prominent nerves, of which the three principal ones are produced into short terminal points or teeth, the central one rather the largest.

Value as a Fodder.—Unknown; not likely to be important on account of its rarity. It may also be mentioned that its affinities are with two genera not distinguished for yielding nutritious grasses.

Habitat and Range.—Confined to New South Wales, and only recorded from the Blue Mountains. It is one of the rarest of our grasses.

Reference to Plate.—A. One of the flat spikelets enlarged and opened out. B.C. Two pairs of glumes, showing a tuft of short hairs under each flowering glume. D. End of a flowering glume, with its five prominent nerves, three of which are produced into short terminal points.

No. 44.—The Reflexed Panic Grass (*Panicum reversum*, F.v.M.)

Botanical Name.—Panicum, already explained; *reversum*, Latin, turned back, in allusion to the way in which the spikes are reflexed (bent, or turned back), as shown in the drawing.

Botanical description (*B. Fl.*, vii., 478).—A weak glabrous, rather glaucous, much branched grass.

Leaves long and narrow.

Panicle usually of three or four simple, distant branches, at first erect, but soon spreading, and at length reflexed like those of *P. distachyum*, but the

Rhachis generally though not always dilated, produced into a rigid point beyond the last spikelet, and bearing under the lowest spikelet a rigid linear bristle (an abortive branch ?) as long as the spikelet.

Spikelets not numerous, alternate and distant along the rhachis so as to appear in one row, ovoid oblong, fully 2 lines long in some specimens, rather under in some from Western Australia.

Outer glume three-nerved, obtuse, at least three-quarters the length of the spikelet.

Second and third glumes equal, many-nerved, both empty in the spikelets examined by Bentham, but Mueller found a palea in the third.

Fruiting glume hardened as in the genus.

Value as a Fodder.—We know very little about the value of this grass for fodder, but, as it is very easily recognised, perhaps friends in the interior will keep it under observation. It certainly belongs to a group which contains a number of fodder plants known to be very valuable to the pastoralist, and the appearance of this grass leads one to the belief that it yields a fair quantity of tender herbage. Baron von Mueller records that at the Murchison River, in Western Australia, it attains a height of 3 feet.

Habitat and Range.—Found in all the colonies except Tasmania and Victoria. It is a native of the drier parts of the colony.

Reference to plate.—A. Portion of a spike, enlarged, showing the flattened rhachis, which ends in an awn-like point, and the rigid awn-like bristle under the lowest spikelet. B.C. Spikelet dissected, showing the outer and second and third glumes, also the fruiting glume and palea. D. Spikelet, showing relative size of outer glume. E. Grain. Note the characteristic way in which the spikes are bent back or reflexed.

Panicum reversum, F. v. M.

"Reflexed Panic Grass."

Botanical Notes.

Note on two so-called Madagascar Beans.

Introductory.—A good deal of confusion frequently arises as to the botanical origin and even the uses of the lesser known vegetables, and because it has come to my knowledge that some people are not clear as to what is known as the Madagascar bean, I offer a few remarks on the subject. Of the two beans which masquerade under this name, neither is entitled to the designation; but it may be convenient, in this Colony, to permit bean No. 1 (see below) to continue to enjoy the appellation.

Both furnish very large plants, say 40 or 50 feet long, with many lateral branches, so that, in suitable places, they may be recommended for rapidly covering any unsightly object. Except in the warmer parts of the Colony, they are cut down by the cold of midwinter.

No. 1 bean is the one whose use I especially desire to encourage, and it is every bit as desirable as the Lima bean as regards palatableness and nutritious properties, and equally accommodating as regards soil and situation. Neither will flourish in the colder districts of the Colony.

No. 1.—A variety of the Lima or Duffin Bean.

Phaseolus lunatus, Linn.; var. *inamœnus*.

The ordinary Lima bean goes under the botanical name of *Phaseolus lunatus*, Linn. The bean now under discussion is often known as *P. inamœnus*, Linn., but it is really only one of the many cultivated forms of *P. lunatus*. De Candolle (*Prodromus*, ii, 393), followed Linnæus in considering *P. inamœnus* and *P. lunatus* as distinct, but this view is not now held. See *Flora of British India*, ii, 200. It cannot be dissociated from the Lima bean which is commonly cultivated throughout India as a vegetable, and which is often known to Anglo-Indians as "French bean." De Candolle states that the Lima bean is a native of Brazil, and that it is believed to have come to India originally from the Mauritius.

It is a tall biennial, and the pod is about 4½ inches long and 1 broad.

When young the pods are eaten like French beans; when old the pods become coarse, but the beans themselves are excellent eating. It is one of my favourite vegetables, and I cordially recommend it to further attention. If lightly fried in butter, like broad-beans, they are a dish fit for a king, the flavour being far more delicate than that of broad-beans. The younger the beans the more delicate they are, but it is rather extravagant to gather them until nearly ripe, and even at that stage they are not coarse.

Mr. Bailey tells me this bean is very largely used and much esteemed in Queensland.

No. 2.—The Lablab or Sim Bean of India.

Dolichos lablab, Linn. (Syn. *Lablab vulgaris*).

This is quite an old introduction to the Colony. Some old records of the Botanic Gardens, dated 1828, show that it was received here from Egypt, and cultivated in these Gardens in 1819, and, considering our previous frequent communication with India, it may have found its way into the Colony earlier still. It has been cultivated in India for thousands of years.

A gentleman brought this bean to the Botanic Gardens under the name "Madagascar Bean." He stated that he had taken it to a leading firm of seed merchants, who had informed him that it was poisonous. His family had, however, used it regularly as a culinary vegetable for the last six months, and it is, of course, a well-known article of food in India and elsewhere. I just relate this incident as showing that the lablab bean is but imperfectly known in this Colony. Mr. Valder informs me that he has received it under the names of Madagascar bean and Tonga bean. The lablab bean is found in every collection of Indian pulse. Usually it is either white or black, but sometimes it is red, or of a pale-brown colour. When Curator of the Technological Museum I must have received it, or had it brought under my notice, hundreds of times, but the appellation "Madagascar bean" for it is new to me.

A form sometimes known as *Dolichos purpureus* has purple flowers, purple stems, and even purple pods, being quite of an ornamental character. I have received it as Tonga bean, but although it might be cultivated in that island, Tonga has no more claim to give it a name than New South Wales has.

The young pods are eaten like French beans; the beans themselves are eaten, but they are coarse and are not generally liked. This bean is distinctly inferior to No. 1 bean as a vegetable.

· *Reference to Plate.*—AA. Pod and seed of *Phaseolus lunatus*, Linn., var. *inamœnus*. BB. Pod and seeds of *Dolichos lablab*, Linn.

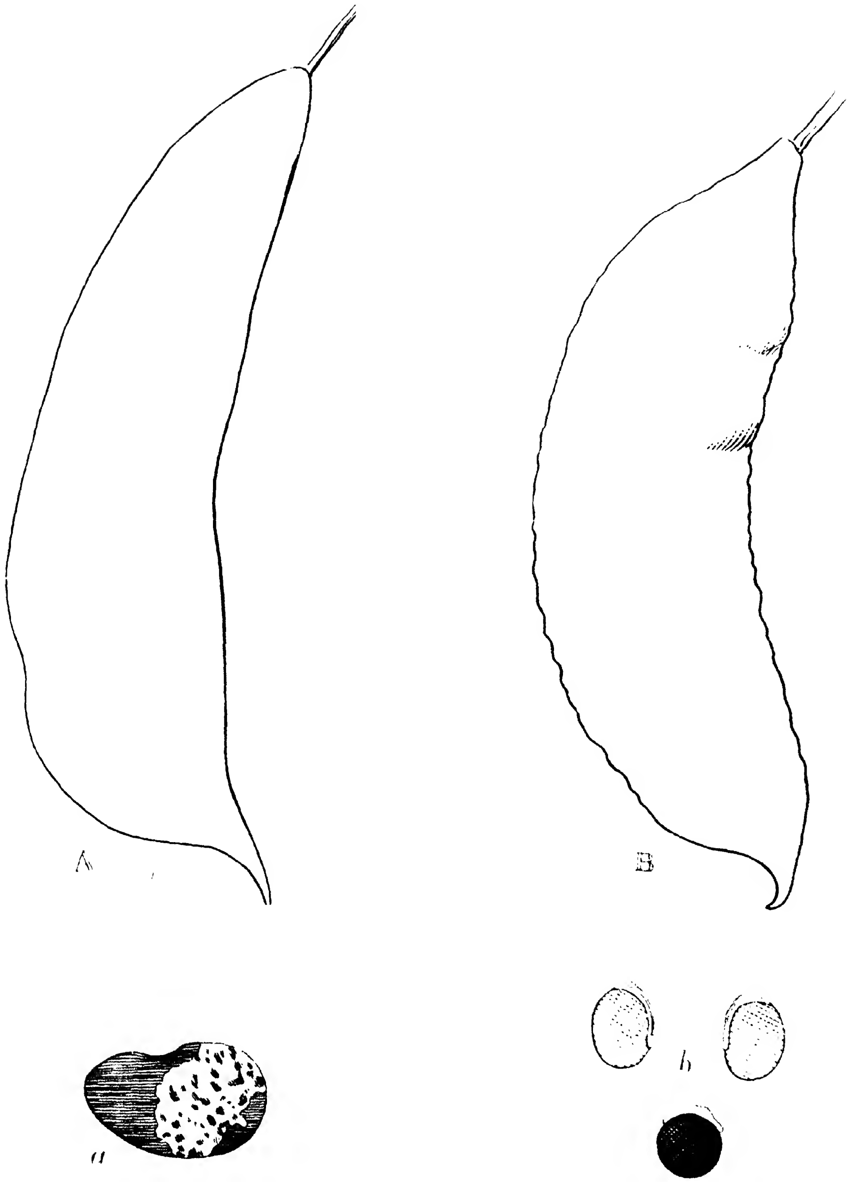
It will be observed that the two pods resemble each other a good deal in outline.

WEED ERADICATION ON A CANADIAN RAILWAY.

FOLLOWING is a note from the recently published Annual Report of the Botanist of the Canadian Department of Agriculture, taken from the Report on Experimental Farms of the Dominion (pp. 177, 178):—

"At this latter place also I was enabled to examine a patch of the so-called Russian Thistle (*Salsola kali*, L., var. *tragus*, DC.) This patch was on the banks of the Northern Pacific Railway. At the time of my visit, June 29, the young plants were very small, only an inch or two high, and great care was being taken to eradicate every plant. Gangs of men were specially employed all the summer by the railway company to attend to this work of destroying dangerous weeds. Upon inquiring at the end of the season how the clean state of the railway which I observed at the end of August had been maintained, Mr. J. E. Riley, the roadmaster, answered as follows, through Mr. G. W. Vanderslice:—

"In the matter of destroying noxious weeds during the past season, we have made it a point to go over all the right-of-way, at least once a week, and cut all that could be found, and where there was Russian thistle oftener.



Two so-called Madagascar Beans.

(A) "Phaseolus lunatus." Linn

(B) "Dolichos lablab," Linn

We did not allow any of them to go to seed, and intend to follow this up until they are all exterminated. If the farmers would do the same, we should in a short time have none in the country."

This is properly dealing with noxious weeds as if they were mad dogs or smallpox. If the eyes of our farmers and pastoralists could be so far opened that they might understand what are our *worst* weeds, those whose presence means deterioration of their property, and those which have such vitality that they take possession of land for a long period of years, they would undoubtedly act, and act promptly. But in many cases farmers when they see a new plant springing up in their fields and paddocks do not know its noxious nature, and so allow it to spread and work destruction. Then, when they are thoroughly alive to the nature of the pest, it is often too late to take steps for its eradication. The moral of all this is that our farmers should try and learn which are noxious weeds and which not; and, in case of doubt, all suspected or unknown plants should be sent to the Department for identification. (See the *Agricultural Gazette* for March, 1895.)

A Note on Sulla or French Honeysuckle. (*Hedysarum coronarium*).

Following is a note on this plant, received by me from Mr. J. M'Ewen, Superintendent of the State Nursery at Campbelltown, in July, 1897:—"On the 21st July, 1896, you forwarded me a small packet of this seed, which I had sown on the same day on well-prepared loamy soil, the ground at the same time being very dry. In about three weeks hence a very few seeds germinated, and owing to the dry spring and summer of 1896 the young plants made very little growth, and were just visible. When the fine rains of the early part of April, 1897, fell, the plants then started into rapid growth, and have made very fine growth ever since; and at present a few plants cover a diameter of 4 feet of ground. One plant I have cut over, and find the leaves and stems weigh 4½ lb.; this I have forwarded to you per rail this day. I am of opinion that this will make a very fine succulent winter forage plant if grown on good soil. I have given some leaves and stems to horses and cattle, and they eat it greedily and with great relish. Of its nutritive qualities I cannot speak, as I have only given a very small quantity of leaves and stems."

"I may add that after the rainfall of early April a number of seeds germinated, and are now plants with a few small leaves. This proves that the seed contains great germinating power, as this seed lay nearly on the surface of the ground throughout the intensely hot spring and summer of 1896–97."

This plant has elsewhere been recommended for bees. It is, no doubt, a useful plant, and may be recommended for cultivation to a reasonable extent. The following note is from the *Treasury of Botany*:—"It is the plant commonly known in English gardens under the inappropriate name of French honeysuckle, it being a native of Italy, and having no affinity with *Lonicera*. Its latter name it owes, no doubt, to its similarity to red clover, often called honeysuckle by country children from the use they make of its sweet flower-tubes. In Spain and Italy it is gathered in great quantities as food for cattle. In France and Germany it is called Sulla."

Melanose.*

G. B. OWEN,
Castle Hill.

In August of last year Dr. Cobb and Mr. Benson, at the request of the Castle Hill Branch of the Fruitgrowers Association of New South Wales, visited the Castle Hill district to see the effects and to suggest a remedy for a disease that of late has been making rapid strides amongst the citrus fruits of Central Cumberland, then commonly known as orange rust, and by some confused with Maori. On further examination Dr. Cobb was convinced that the disease was fungoid, and I undertook to carry out some experiments under his instructions with Bordeaux mixture.† Dr. Cobb has dealt very ably with the disease on page 225, Vol. VIII, Part 4, of the *Gazette*, and I, here only intend to deal with the experiments carried out upon his suggestions. The bed experimented on was eight trees long and four wide, of fairly large trees some thirty years old, lying north and south, most of which were badly affected, some of them especially so. This bed was divided into two portions, the eastern and western, and it was determined to spray the eastern with Bordeaux mixture, containing 3 lbs. of sulphate of copper in every 40 gallons of water, the spray to be applied monthly, and the western portion with a mixture of half the above strength, made simply by adding double the quantity of water, and be sprayed every ten days.

The whole bed was treated to a dressing of coarse bone-manure at the rate of about 6 cwt. to the acre, and of sulphate of iron 1 lb. per tree. The first spraying was done on October 29 as soon as the crop was off, and owing sometimes to the weather being not suitable for spraying and sometimes to the pressure of work that comes at times to every grower of any extent; the sprayings were not carried out quite as often as suggested. The following are the dates of the subsequent sprayings of the eastern portion:—November 28, January 13, February 11, March 9, May 4, or six sprayings in all; the western portion having two additional sprayings on November 10 and January 10. It may be as well to point out that by each spraying is meant the covering of the whole tree as far as possible with minute drops of the mixture, and with this view the trees were gone over at least twice and sometimes three times each spraying. The expenses of these sprayings total £3 7s. 6d.—material 7s. 6d., labour £3—the cost of which is saved the first year the trees bear a fair crop, and it must be borne in mind that this expense will not have to be incurred every year, as the result of these experiments has proved that Bordeaux mixture thus applied—and further experiments may show that less sprayings may be as effective—will

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* As described by Dr. Cobb.

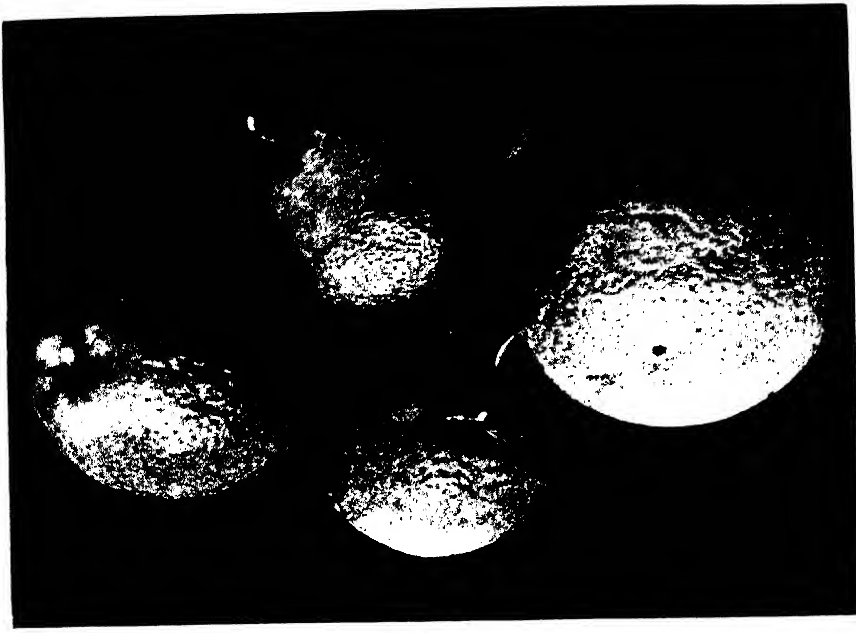
† For making Bordeaux mixture follow Dr. Cobb's very explicit directions, Vol. VIII, Part 4, page 219.

FROM ORANGE TREES (*Not Treated*).

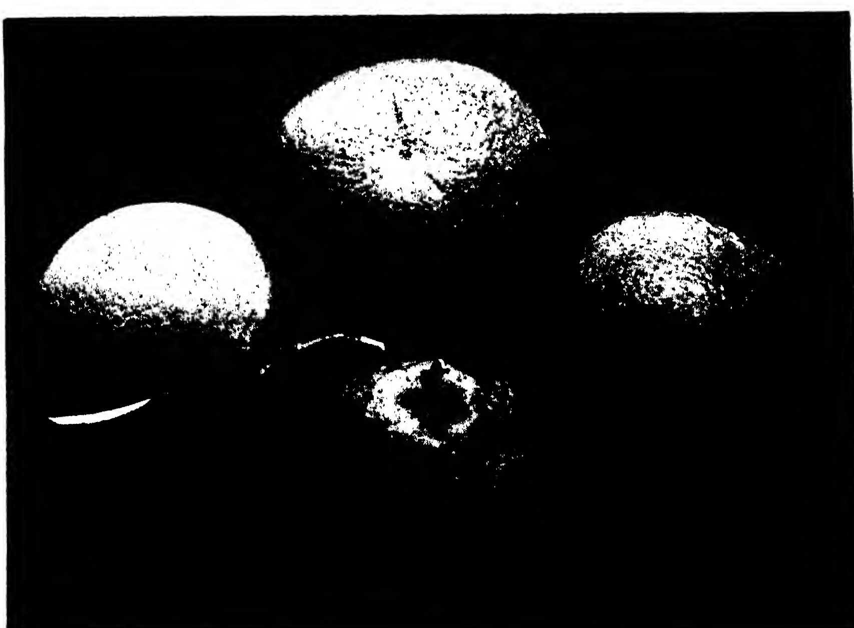
Fair sample of the worst oranges on an unsprayed tree.

Fair sample of the best oranges on an unsprayed tree.

From Orange Trees (*Treated*).



Fair sample of the worst oranges on a sprayed tree.



Fair sample of the best oranges on a sprayed tree.

rid the fruit of disease, and, consequently, one or two sprayings a year—made, I should say, firstly, soon after fruit is set, and again when half-grown—will prove to keep the trees clean in future.

As far as I have been able to find out, there are only two oranges affected with the disease on the whole bed, whereas last year it was hardly possible to find a clean fruit; and the trees, in spite of the droughty season, look better than they have done for years. Sulphate of iron, dissolved in water, was applied around certain of the trees at the rate of ½-lb. to a tree, given in three separate doses, through a watering-can; but, as far as I am able to judge at the present time, there is little or no difference between those so treated and the rest.

Of these two treatments I recommend the stronger one (3 lbs. sulphate of copper to 40 gals. of water), as the sprayings are less frequent, and that strength, from my experience, is perfectly harmless to either the young fruit or wood; and the cost will be found very trifling to anyone who has good orange trees, as this disease completely discolours the fruit and will not allow it to develop, and thus renders orange trees, that ought to be a source of profit, only an eyesore and expense. Again, the Bordeaux mixture will cure the Black Spot, which has been so persistent amongst the later marketed oranges; and thus one can "kill two birds with one stone."

The trees themselves, I regret to say, do not show the effect of the sprayings in the marked degree that the fruit does, but no doubt a strong dose of Bordeaux mixture (say 8 lbs. sulphate of copper to 40 gals. of water) before the spring growth, would have the desired effect; the young wood and leaves on these trees are clean, thus showing that the weaker spray was a preventive, and in all probability the stronger one would prove a cure. The accompanying illustrations are from photos. taken by Dr. Cobb from specimens collected by Mr. Grosse from the sprayed and unsprayed trees in my orchard.

Agricultural Education.

F. B. GUTHRIE.

It is only of recent years that a demand has arisen for special education for the farmer, which shall assist him in his profession. These same years have brought with them so great a revolution in the practice of farming, so great an advance in the methods adopted, that the modern farmer is not properly equipped unless he has some understanding of the principles underlying agricultural practice, and some acquaintance with the sciences upon whose aid his success largely depends.

Farming is becoming, every day more and more, a profession which demands a high degree of skill, and calls forth all the resources, both natural and artificial, which a man possesses; and, consequently, the advantage, as in other professions, rests with him whose previous training has been such as to enable him to use his faculties to the best advantage.

The need of a special agricultural education is becoming generally recognised, and agricultural colleges and schools, the result both of private enterprise and State policy, are in existence in almost every civilized country.

Our own policy in this direction is still in its infancy. We have, it is true, the Agricultural College, but we have not yet any provision for elementary preparatory teaching.

Before this policy finally assumes definite shape, and a complete system of agricultural education is adopted, one may be allowed to express the hope that it will not be so unsuitable for the object in view, as is the education of the rest of the community. In other words one may hope that it will be found possible to provide the future farmer when he is a lad with a training superior to that which is considered good enough for the ordinary professional man.

I fancy there are very few of us who can boast of having received a really good education. We have devoted years to the acquisition of subjects which we are forgetting as rapidly as possible; those subjects which are useful we have had to learn all over again as soon as our alleged education was completed.

We may have received the best education obtainable in our circumstances. Has it been the best possible? and is there any use for inferior systems of education, advantage in any but the most perfect? No education can of course be perfect in one sense, because it can never be complete, but it can be perfect in method and direction; and nothing short of perfection should be admissible.

How does it happen that a man should be regarded as educated, even highly educated, who is quite ignorant of the explanation of the most ordinary natural phenomena, or the commonest contrivances in daily use?

Can that be regarded as a perfect system of education which neglects to supply knowledge, and contents itself with imparting information?

A little *knowledge* is an excellent thing. When ill imparted it becomes *information*, a little of which is certainly a dangerous thing.

How often do we hear that such a one, originally intended for a farmer, became ambitious after attending school, and how nothing would satisfy his ambition but a clerkship. What sort of education is it that turns farmers and mechanics into clerks?

No doubt the educational system is less imperfect now than it was twenty or even fifteen years ago, but there is still considerable room for improvement.

We have yet to realize that the teacher's profession is one of infinitely greater responsibility than any other, that a bad teacher can do more to hinder human progress than any individual in his generation. A bad or imperfect system is equally dangerous. When these facts are fully recognised we shall be enlightened enough to demand for our children an education somewhat less one-sided than our own has been.

In the case of the ordinary professional or commercial man the defects in the school system are perhaps of less importance than with the farmer, because he can to a large extent remedy them at the University or the counting house, where his real education commences as things now stand. For the farmer there is no special training provided except at the Agricultural College, and it becomes a matter of the greatest importance that his school education shall be as complete as possible, so as to provide on the one hand a sound basis for those who are able to attend the college course, and on the other hand to give a fair education to that far larger majority who are unable to complete it at the college.

For, as things now are, the Agricultural College does not stand to the future farmer in the same relation that the University does to the future lawyer or doctor. The ordinary schools are conducted as a rule with the view of fitting boys for College or University, and the teaching is on much the same lines as at these institutions. The teaching at an agricultural college, on the other hand, is confined almost entirely to subjects which are undreamt of in the schools.

The result of all this is that the danger exists of bringing boys in from the fields, where they have been engaged in manual work in which they are interested, shutting them up in a room and presenting to them a number of apparently dry facts of an order quite new to them and of which they fail to see the application. This is the surest way of making scientific subjects uninteresting to a boy, an achievement which is exceedingly difficult by any other means.

Whether or not the attempt to teach scientific subjects and practical farm-work at the same place and time is likely to succeed with us is another question. It must not be forgotten that where this has been done with any measure of success, it has been done without regard to expense. The agricultural colleges in European countries and the United States are not only for the most part amply endowed, but possess a large staff of scientific teachers.

I feel convinced that it is of little use to attempt it unless the students have had a previous training of such a nature as to enable them to make use of the education provided.

This previous training does not exist with us, and the teaching at the college is in consequence greatly handicapped.

I do not propose in this place to submit a detailed scheme of instruction to be adopted in elementary agricultural schools. My object is only to draw attention to the faults in our present educational systems, in the hope that when the time comes to draw up such a scheme, the old mistakes may be avoided.

I should much like to see established a system of farm-schools where the boys would grow up in the midst of active farm-work in which they would occasionally lend a hand.

In such institutions there is no reason why a far more practical system of teaching should not be introduced, and where, in addition to the ordinary school subjects now recognised (and which should be revised both as to their matter and their method, and considerably curtailed), instruction could be afforded in such practical subjects as carpentry, farriery, &c., as well as in elementary science.

Drawing should occupy a prominent position in the curriculum from the very earliest time, perhaps even before writing.

It is slowly becoming recognised that practical subjects properly taught, and especially scientific subjects, have an educational value quite as high, if not higher, than the study of languages, are equally capable of exercising and strengthening the mental faculties, and have the additional advantage of being of permanent benefit in after life.

The adoption of such a scheme will, no doubt, increase the number of subjects taught, though not to such an extent as many suppose.

There need be, however, no cause for alarm on this score. As it is, children are taught too few subjects. A variety of subjects gives relief to a child's mind.

In advocating training in elementary schools in scientific subjects, I wish it to be understood that what I lay most stress on is the training in scientific method, in the habits of exact observation and careful reasoning, rather than the amassing of scientific facts and theories. With regard to the facts taught at the earlier stages, they should be of such a nature as to be easily demonstrable without the aid of books, and of a kind that would awaken the boy's interest, and incite him to deduce from them the existence of natural laws. They could be imparted at the earlier stages in the form of object lessons. The careful study of a few elementary phenomena has more educational value than the cramming of entire text-books.

The boy who is taught the scientific method is taught among other things to observe accurately, to reason carefully and dispassionately, to be honest and truthful, to judge impartially, to avoid hasty generalisations. He realises his own position in the general scheme, and learns the virtues of self-reliance and self-sacrifice.

An education including an elementary knowledge of the sciences is, then, desirable for every boy for its own sake, and necessary for every man who claims to be an educated man; but it becomes absolutely essential if his future career is so closely controlled by scientific laws as is the career of agriculture, and especially so if he is to be placed at an Agricultural College where these sciences are taught.

The extent of this preliminary scientific training should, I think, be only slight and general, and deal more with methods and results than with actual scientific facts. Even in the Agricultural College I am not of opinion that too much stress should be laid on science subjects.

We cannot attempt to turn out expert entomologists, or botanists, or vegetable pathologists, or chemists, at the same time that we make a practical farmer of a lad; nor is it at all desirable we should do so.

All we can hope to do is to insure a grounding in scientific principle and, above all, in scientific method.

That the value of this grounding should be recognised at an earlier stage than is now the case is what I feel to be a matter of the utmost importance, if our lads are to make the most of their College course or of their profession.

Plant Diseases, and the possibility of lessening their spread by Legislation.*

Paper read at the National Convention of Fruit Growers, held at Washington, D.C., March 5 and 6, 1897, by B. T. GALLOWAY, Chief of the Division of Vegetable Physiology and Pathology, United States Department of Agriculture.

IT needs little argument to prove that the enemies of cultivated plants are steadily increasing, and I think it can be easily shown that they will continue to increase so long as the conditions for which we are in large part responsible remain as they are at present. I do not by any means regard this as a calamity. On the contrary, I look upon the fact that our insect and fungus foes are increasing as direct proof that we are progressing; for, as Professor Bailey has said, "Our enemies increase because cultivation induces change of habits in wild organisms; because it presents an ever-increasing variety of food or host plants; because the food supply is large, and in more or less contiguous areas; and finally, because the natural equilibrium or tension is destroyed." It follows, therefore, that the more we put forth our energies to improve our native plants, or to change their habits, the more we endeavour to increase the variety and number of our cultivated vines, trees, and shrubs; the more we extend our orchards, our vineyards, and our fields, just so much more do we disturb the equilibrium in nature, and just so much more must we expect to burden ourselves with the work of maintaining this unstable condition by more or less artificial means. Where an insect or fungus had one chance a hundred years ago to wax strong and spread it has now a thousand chances, for unbroken orchards and vineyards, and millions of nursery trees cover the country, where then only wild plants grew.

It is but natural, then, that man, seeing the onward march of his enemies, should look about him and wonder how it will all end, and how he, as an individual, is to obtain relief. In many cases he has found a way of doing this by adopting certain more or less empirical methods. Again, with a fuller appreciation of the fundamental principles underlying plant growth, he has learned, partly by intuition, to keep his plants in health, and when he has reached this stage, he stands far in advance of his neighbour who waits until his plants are diseased, and then begins to look about for a spraying apparatus. It frequently follows, however, that with all his efforts, he is not able to help himself, and then, in accordance with what he considers his privilege, he appeals to the State, believing, or, at least, hoping, that by legislation he can even up matters, to the advantage of himself and the detriment of his foes.

In answer to such appeals a number of State laws have been enacted; some of these have been partly satisfactory, but none have served fully the object for which they are intended. This is nothing more than might

* Reprint from *Florist's Exchange*, New York.

have been expected, seeing the widely divergent interests of the different States, the lack of anything like co-operation, and the fact that public sentiment in many cases is indifferent or unfavourable towards such laws, thus making proper enforcement impracticable.

I take it that one of the principal objects of this convention is to consider these matters, and, after hearing as many sides to the question as possible, to take some action which will at least lead to a better understanding of what can or cannot be done. Let us then consider for a moment the nature of some of the more common and destructive plant diseases, for it is only in the presence of such knowledge that we can intelligently discuss the problems relating to legislation.

So far as we are at present concerned, the diseases of plants may be divided into two principal groups, namely, those due to organised beings, such as insects and fungi, and those in which organisms take no direct part, as, for example, improper conditions of the soil, such as too much or too little water, unfavourable atmospheric influences, and the presence of poisonous substances in the soil, air, &c. We are not particularly concerned with the insect pests, as they will doubtless receive full consideration from others present.

No hard and fast lines can be drawn between the diseases due to fungi and those brought on by unfavourable environment. Many, if not all, fungus diseases are greatly influenced by environment, just as much so as the hosts themselves. In many cases we find a plant grown with success in a certain region succumbing to disease when transferred to another where the conditions are such as to make it necessary for the plant to adapt itself to the new requirements. During the process of adaptation fungi may find their opportunity, and the host once infested, it may be only a question of time when it is forced to succumb. In such cases it would be obviously unjust to hold the man who grew the trees responsible. It was not his fault that the conditions under which the purchaser planted the trees were different from those nature furnished him to grow them.

A case in point will more clearly illustrate this matter. Suppose I purchase 1,000 apple trees from a nurseyman and plant them in what to all intents and purposes is a suitable piece of ground. This ground may have recently been cleared, and in addition to the remains of roots of certain forest trees, the soil may be slightly wetter than that of the nursery. The decaying roots of the forest trees in the soil may contain the mycelium of a fungus, which under ordinary conditions would not attack a healthy apple root. Owing to the slight additional wetness, however, and the consequent lack of aeration, some of the apple roots in time will be asphyxiated or will be injured in other ways, the details of which need not be given here. While the roots may be only slightly injured, they nevertheless in this condition become readily susceptible to the attacks of the fungus already in the soil, and once started all the roots may eventually be killed and the tree will die. Hundreds of trees may be killed in this or some similar way, and yet from the very nature of the trouble, the delicate questions involved and the complications that may arise, no man could positively assert where the blame rests.

We are by no means holding the nurseryman up as a paragon of honesty, but we do wish to give him fair play, for he is unquestionably often blamed for things for which he is not in the least responsible.

Again, there are a vast number of fungus diseases which are almost as universally disturbed as the host plants themselves. They occur not only on the cultivated farms, but everywhere in the woods and wild places, whence they doubtless originally came. Such is black rot, downy mildew, and

powdery mildew of the grape; apple scab and rust; and a host of other maladies. It would be manifestly as impossible to control such enemies by legislation as it would be to control the dust of the air or the wind that wafts it from place to place. Furthermore, it must be remembered that a great many, in fact the majority, of the most destructive diseases which affect nursery stock are of such a nature that no reliable system of inspection can be carried out. Such being the case, we are free to say that in most cases the certificates that are given declaring trees to be free from disease are little better than worthless. Ten thousand peach trees may be shipped into a State, and, so far as anyone can determine, they may be perfectly healthy. Notwithstanding this, 50 per cent. or more of the trees may be infected with yellows, and what is more, the malady may not develop for a year after the trees have been planted. What is true of peach yellows is true of many other diseases, particularly those where the leaves alone are the parts attacked.

Without further argument, therefore, it may be said that any general laws looking towards the control of nursery stock are likely to prove impracticable, first, because the nature of the diseases is such as to render proper inspection exceedingly difficult, if not impossible; and, second, no one with any regard for scientific truth or accuracy would care to risk his reputation in giving an opinion where so many complications are involved. Of course, there may be special cases where laws would be an advantage. Take, for example, pear blight in the nursery. Young trees may become infested and the disease remain dormant in the trees until the latter are set in the orchard. Inspection here might be of benefit, but it is questionable whether legislation would facilitate matters in the least. Probably not one nurseryman in a thousand would refuse to take the proper precautions for eradicating blight if the way was pointed out to him. It would be a matter of business for him to do so, and this introduces the question as to how far many of the problems involved in the matter under discussion could be controlled by proper organization among the experiment station workers and others who might be easily induced to co-operate with them. I can see no reason why a properly organized force of this kind, acting throughout in a uniform manner, could not accomplish much good, not only in educating the nurserymen and others interested in the lines of work that should be followed where emergencies may arise, but also take such legitimate and proper action where the exigencies demand as to make it to the interest of all owners of nursery stock to be able to truthfully say that they have put forth every effort to have every tree sent out absolutely free from dangerous insect, fungus, or other pests.

So far, our discussion has dealt mainly with the nurseryman. It must be remembered, however, that there are other phases of the problem. The fruit grower himself is to be considered, and may often prove an important factor to deal with. The energetic, successful man, who puts forth every effort to keep his trees free from the various foes which beset them, may often have his best efforts rendered more or less futile by the fact that his neighbour's trees harbour all sorts of insects and fungi. It is a delicate matter to say what shall be done in such case. The man whose trees are infested may not be shiftless. He may be the victim of natural laws, for which he is in nowise responsible, or he may, for personal or other reasons, not be able to care for his trees as should be done. To hold the law over this man and say that he should spray his trees or destroy them or else pay a fine or go to gaol would be manifestly unjust. Public sentiment would support him, and therefore the law, if it existed, could not be enforced.

Finally, there is a question of imported pests to consider. What has been said of the impracticability of inspection laws will also apply here. It may sometimes happen, however, that a dangerous pest is imported, and although established in one or more places, might be quickly and easily eradicated by prompt and intelligent action supported by proper legislation. Even here, however, the futility of State laws can be seen, for the pest may be established at isolated spots in three or more States. and while the laws of one State may make it impossible to exterminate the enemy, those of the next may be wholly powerless to cope with it. In such cases, and also where any pest hitherto confined to comparatively limited areas, shows an alarming tendency to spread, proper federal legislation might serve a useful purpose. As to what would constitute proper federal legislation is not within our province to say, as the complications involved are far too numerous to be considered here. Suffice it to say, however, that the precedent for such legislation seems to have been established in creating the Bureau of Animal Industry, of the United States Department of Agriculture. By this act the head of the Department is given the power to prepare such rules and regulations as might be deemed necessary for the speedy and effectual suppression of the diseases of domestic animals. Necessary rules and regulations are to be certified to the executive authority of each State and Territory, and said authorities are to be asked to co-operate in the enforcement and execution of the act. This removes all difficulties that may arise between federal and State authorities, and gives the head of the Department power to act whenever an emergency may arise. The rules provide for the necessary means of bringing to the attention of the Department any contagious or communicable diseases, the appointment of inspectors, the quarantining of the infected localities, the destruction of the diseased animals, and compensation therefor whenever the latter is recommended by a Board of Appraisers appointed by virtue of the act in question.

Whether such a general law, or a similar one, could be made operative in the case of insects and fungi is a question. Public sentiment is not as yet very far advanced in such matters, and public sentiment is what makes a law operative. In any event, it seems to me that a law, no matter how drawn, would prove useful only in certain special emergencies. The greater portion of our plant diseases and insect pests cannot be reached by legislation. They are governed by natural laws, and it is to these that we should turn our attention. Let us strive therefore to obtain more light on Nature's fundamental truths, for one such truth well understood may prove of more lasting benefit than legislation without end.

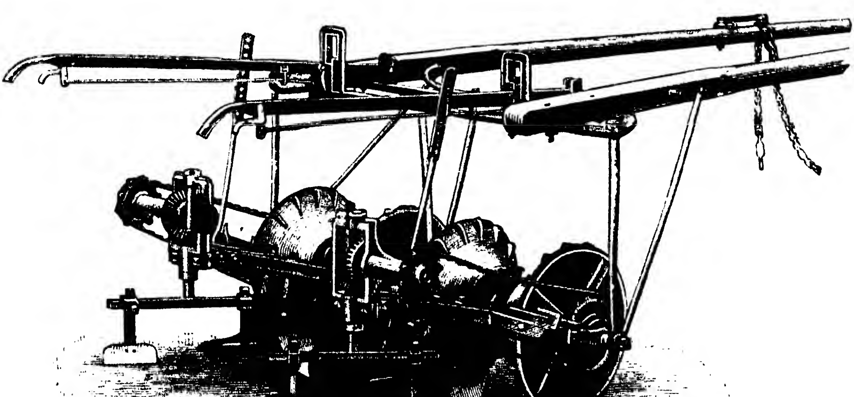
New Labour-saving Implements.

J. L. THOMPSON.

In these days of keen competition all over the world, any implement or machine that will increase the profits and save the labours of the husbandman, will be hailed with gratification by all engaged in the cultivation of the soil. At the Hawkesbury Agricultural College farm during the past seven years, a number of improved implements have been tried, and, in giving a short account of each in this series of articles, I should like readers to understand that the results given are simply those achieved in my own experience of the practical working of the machines on land of good tilth. In my opinion, good and satisfactory results can be secured from any implement of intricate mechanism only on land that is well cleared and broken up.

Wardlaw's Patent Horizontal Revolving Turnip-thinner.

The accompanying diagram illustrates Wardlaw's horizontal revolving turnip-thinner, manufactured by Messrs Flear and Thomson, agricultural engineers, Dumferline, Scotland.



Wardlaw's Turnip-thinner.

This machine makes good work, is strong and simple in its arrangements, and is made to work with either two or three hoes, which are easily adjusted by means of different pinions, leaving the plants 8, 9, or 10 inches apart. The hoes cut about an inch below the surface of the drills.

The thinner has been worked successfully by the youngest and most inexperienced of the students on the College Farm. It will thin the plants, and thoroughly clean 8 to 10 acres a day, the only handwork required being to run along the drills, and take out a plant where two are occasionaly left together; and this can be done in one-tenth the time when following the machine.

As agriculture advances in New South Wales, I am convinced the growing of turnips will play a more important part in our operations. Swedes are a most profitable crop, and on the best of the College Farm land, in good seasons, we have harvested 15 tons per acre, and sometimes as much as £3 per ton has been realised by auction in Sydney.

Turnips cannot be surpassed for topping-up crossbred sheep as freezers for export. They are also invaluable as a rotation crop, and preparatory for cereals.

The Wardlaw thinner will also be found useful in thinning sugar-beets, and, where that crop is extensively cultivated, should be a valuable acquisition. The price paid for the machine procured for the Department was £12.

The Influence of Bees on Crops.

(Continued from page 584.)

ALBERT GALE.

THAT pollen is the vital agent in the production of all fruit crops, and also the life-cell in the reproduction and perpetuation of all phanerogamic plants, *i.e.*, plants having conspicuous flowers, has already been shown. In this division of the vegetable kingdom it has been pointed out that reproduction is the result of a union between ovules and pollen grains, the former being the cells of matter, and the latter the life-cells. The methods or agents employed by nature to bring about this union are various. In nearly all of them, excepting that of the union that is produced by insects, it is extremely haphazard. Indeed, the union that is brought about by insects is almost as fluctuating as that of other agencies, if we except the bee family, and this family must be gradually narrowed down to the hive-bee as the one *par excellence* in the art of fertilisation. In the majority of entomophilous plants it is almost impossible for fructification to take place but by contact with an outside agent, and the only agents designed by nature by their construction, instinct, and domestic requirements are members of the bee family. In all parts of the world there are many thousands of species and varieties of insects. Yet out of this vast army of unique and, in some instances, grotesque forms, having peculiarities adaptable for the life they have to lead, and for obscuring themselves from enemies by resembling the plants, &c., upon which they live, the only ones that collect and store pollen are bees. When other insects carry pollen it is entirely accidental. Bees cannot live without it. It is their bread of life. Their young cannot be nursed to perform the active duties they have to follow without it. In the insect world there are artisans in paper-making, in spinning, in weaving, in basket-making, in house-building, in masonry, in sawing, in carpentry, in upholstering, &c., each one of them having tools or instruments specially suited for carrying out the work nature has intended them to perform; but the only ones having instruments and appliances for gathering, carrying, and storing pollen are bees. Pollen is removed from the anthers and conveyed to the receptive organs of flowers by every variety of insect that alights on them during the time the pollen is distributive. By reason of the viscid nature of the pollen grains of most entomophilous flowers it adheres to the body or legs of any insect that may chance walk over it, and is conveyed by them elsewhere. If it were brought in contact with the pistil of a flower of its own variety, the act of fertilisation would be as efficacious as if it were carried by bees; but these cases are purely accidental, and the successes are only "few and far between." Not so with the bee. Every movement of a bee in the direction of fertilisation is a studied one designed purely by Nature to accomplish the perpetuation of the plant it is at work upon. The anthers of some flowers are so situated as to discharge the pollen only on some very

particular spot of the external anatomy of the bee—her head, upper surface of the thorax, chest, tongue-sheath, &c., and the stigma is so placed in the flower that only that portion of the bee that has received the pollen would be capable to effect the purpose.

I have used the term bees (*Apidæ*) frequently to indicate any member of that extensive family, but all or every variety of bee although both honey and pollen gatherers, are not capable of general fertilisation. It is only the most highly developed bees (humble bees and honey bees) that are furnished with apparatus suitable for collecting and carrying pollen from flowers of *all* forms or designs. Mason bees and leaf cutters (*Osmia* and *Megachile*) have the ventral surface of the abdomen furnished with long stiff retroverted hairs. These hairs by pointing the "wrong" way brush the pollen from the anthers as the insects pass in and out of the bloom. Grains of pollen become entangled among them, and by this means they are transported elsewhere; the hairs on the abdomen of such insects are beautifully adapted for the fertilisation of flowers having a broad and flat corolla, and the reproductive organs being protuberant or conspicuous. If the female organ be hidden low down in the long narrow tube that some blossoms possess, such as clover, &c., they are utterly incapable of performing the uniting ceremony required to produce a fertile seed. Figure 1 is the hinder leg

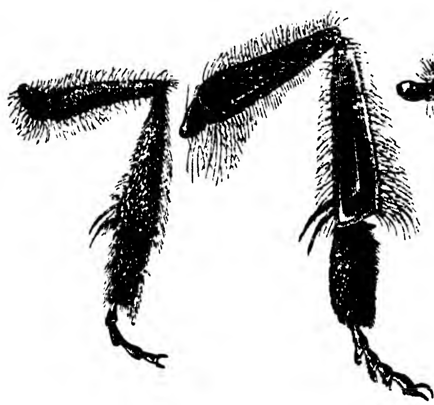


Fig. 1. Fig. 2. Fig. 3.

of one of the hairy bees, the white specks indicating the pollen collected in the hairs afterwards to be transferred to the pollen baskets. Figure 2 is the hinder leg of one of the humble bees (*Bombus terrestris*), and it will be noted the arrrangement of the pollen-gathering hairs are carried out with greater perfection, but the hairs are distributed in the same irregular manner as in the hairy bee. Figure 3 is that of the ordinary honey bee (*Apis mellifica*); the pollen-collecting hairs are much better adapted to their designed use than is the case with the two former. The hairs on that section (tarsus) of the leg are arranged, not in the irregular way as is the case in that of the humble bee, but in eight or nine regular rows. This regularity of the arrangement of the hairs of the pollen-brush enables our domesticated bee to brush the grains of pollen from the anthers far more effectively than is the case with any other member of the whole species. Whilst she is at

work on the flowers she is constantly transferring these grains to the pollen baskets, but *all* are not stored therein; some escape, and it is these escapees that do the work of fertilisation.

I think I have pointed out clearly that there is no insect so highly developed for carrying the imperatively essential pollen from flower to flower as the hive-bees. Their intelligence, their energy, their social habits, and the ease with which they are kept under control stamp them at once as no mean ally to the tiller of the soil. The practical beekeeper in any district is a confederate that should be welcome to all. The indiscriminate destruction of native honey-producing flora should be carefully avoided, because most of the plants that I have referred to in these articles are exotics, and these, as a rule, bloom in the early spring and the pollen and honey obtained therefrom is used in the spring and summer for the raising of young brood. The stores gathered from indigenous summer and autumn flowers are to carry them over the severity of winter. If there be not sufficient storage when the cold and wet season sets in to carry them through till springtime it will cause an insufficiency of bees to do the work nature has assigned for them, and the result will be a lesser ingathering of the fruits of the tillers' labours. Landowners and others cannot have the remotest idea of the mischief they are doing to the vegetable kingdom, and therefore to mankind, by the wholesale destruction of our native flora. If these are wholly, or nearly wholly, cleared from the land to the extent of giving insufficient winter storage for our bees so as to decimate them to the extent of their numerical inability to carry on the necessary work of fertilisation the result will be more disastrous than droughts or floods, because our fruit trees, &c., would cease to yield their crops.

The sons of our agriculturists and others engaged on the land are instructed in pruning, grafting, budding, and other concomitant adjuncts for procuring a living from the soil, but none of these are more necessary than an acquaintance of bee-management—the practical part of it at least. Apart from the profits from the sale of the honey obtained from the bees, or that used in the home (there is no food more healthy and invigorating), the presence of bees on a homestead are as necessary as the implements of husbandry, nay indeed more so.

(*To be continued.*)

Profitable Poultry Breeding for the Local and English Markets.

GEO. BRADSHAW.

Introductory.

After accepting the appointment in connection with the "Export Poultry" trade, it was my intention during the present winter to produce a work on the subject, dealing exhaustively with the poultry question in its various forms, particular reference being given to profitable breeding for table and market purposes and an egg supply. Since then, however, the prizes offered by the Board for Exports at the various Shows and the Board's pamphlets have created such an interest therewith, that it has been found impossible to reply to the numerous correspondents and inquiries on the subject, with the result that I have decided to postpone the voluminous work in favour of a more concise and practical handbook, embodying all the subjects which will be contained in the larger one. That the need of such a pamphlet exists is evidenced by the fact of the thousands of miserable poultry which weekly find their way to the Sydney sale-yards, while to find scarcity of eggs in the same city for periods of the year, is a serious reflection on producers so favoured with a country whose climatic and other conditions are the most favourable in the world for successful poultry-keeping.

The work is the result of personal observation, all technical terms and theoretical opinions being studiously avoided; no attempt has been made to invest the subject with interest by the means of fine phraseology, the object being to furnish a useful and practical work which may prove as beneficial to the novice as to the more experienced breeder, and from which both may derive assistance and instruction in the pursuit of poultry-keeping, whether for the local or English markets.

Of the various rural industries of the Colony, none of late years is receiving more attention than that of poultry-keeping; the subject being invested with still more interest since the Board for Exports announced their intention of furthering the interests of this important branch of agriculture by grading and otherwise supervising shipments intended for the English markets.

The many letters of inquiry to the Board, press references, and discussions as to the most suitable varieties is the only apology for the present work, which, I trust, will go far to place outside the region of dispute the question of what really are the best breeds and crosses, the best methods of treatment, the dangers to avoid, and other matters calculated to prove that poultry-keeping, whether for our local or English markets, can, like other businesses (if conducted in a business way), be made a profitable undertaking.

Should the result of the pamphlet be an increase in our egg supply, and an improvement in the quality of our market poultry, the Board's object will be attained.

Chapter I.

When producing a work on poultry, of whatever extent, the hitherto customary plan has been in the form of chapters, beginning with the "Sitting hen," "Nest boxes," "Coops," "The feeding and rearing of chickens," "Incubators," "Houses," &c., the last, and usually the longest, being devoted to "Diseases." The present work will, however, for substantial reasons, be a distinct departure from the orthodox, inasmuch as the parties for whom it is intended—the farmers of the Colony—have long since mastered the rudiments of poultry-keeping, the information contained herein being more in the way of general recommendations, up-to-date methods of management, and the adaptabilities of the various breeds.

So far as the sitting hen is concerned, it is very well known that farmers' wives and daughters, even with their present loose methods, want of system, and closely related inbred stock, have much larger broods of chickens than has the poultry-fancier, with his pure-bred, prize-winning, imported stock, patent nest-boxes, and up-to-date literature on the subject; while, coming to the rearing of the chickens, the females of the farmer's household, with the commonest ways and simplest diets, bring to maturity the largest broods with the smallest percentage of loss, the prize poultry-breeder meantime, with his chopped eggs, patent foods, special grit, shell, &c., congratulating himself when able to bring 40 or 50 per cent. of those hatched to a marketable age. Confirmation of this can best be found in the fact that it is now no uncommon thing for the fancier to have arrangements made with farmers or other country residents, who, for a consideration, receive the eggs from the fanciers, hatch, and rear the chickens for them, the advantages being that larger percentages are reared, while the free range, fresh soil, and more natural food and conditions, conduce to the stock being more healthy and vigorous than that reared in the sometimes confined runs or yards of the prize poultry-keepers.

Concerning houses or housing there is little need for reference on this head. Fowls can adapt themselves to almost any circumstances, and if well fed, and otherwise fairly attended to, they can be kept as healthy and thrive as well roosting in the open bush in the coldest part of the colony as those in the more temperate parts carefully housed in ornamental buildings, constructed on the most scientific sanitary principles. I do not for a moment either recommend or advise the open-air principle, my object being rather to show that the income from 12 or 20 broods of good chickens in the year would be a welcome addition to the farmer's income, and that to rear these there is no need to make special erections, since the spare out-buildings of the farm can be well utilised for this purpose.

However necessary artificial incubation may be to the poultry-fancier for the supply of early-hatched chickens, or to the large breeder for a continuous supply, for the farmer the incubator is undesirable.

Fowls on a farm are kept under more natural conditions than with the suburban breeder, the result being that broody hens are obtainable nearly all the year round. Indeed, if the proper stock be kept, and the hatching arranged to keep up a continuous egg supply, the outcome will also be a succession of broody hens.

Coming to diseases of poultry, which are usually exhaustively treated of in poultry works, the causes which warranted me in dispensing with other branches of the question also oblige me to but lightly touch on this. Poultry diseases are many and varied, and in spite of all the "sure cures" many

thousands of all ages annually die from one complaint or another. Fortunately, however, of all the classes of people who breed fowls none can show such a clean bill of health as do the farmers of the Colony, disease rarely reaching them except by the introduction of fresh blood from some infected yard. In connection with diseased poultry-yards I should here mention that the Press of Victoria have of late been giving much attention to the question, it being first brought into prominence by Mr. David Wilson, the dairy expert, in his annual report in May last. It was well known that the poultry export trade of that Colony was not of the development commensurate with the great assistance given to it by the Agricultural Department, and that after three years' nursing no improvement was noticeable in the market poultry, resulting in Mr. Wilson giving both thought and research for a solution of the unsatisfactory state of affairs; the outcome of such investigations are embodied in his report, from which I take the following extract:—"I regret to have to complain of the very large percentage of inferior and even diseased birds that are consigned to the depôt for export. These are all promptly rejected as being unfit for export, the inspection necessarily having to be very closely carried out. If the farmers would only send suitable birds for export a large and profitable trade could be developed. There appears to be a difficulty in getting poultry of the proper type. I learn from the farmers that they hesitate about introducing the proper breeds for export to their flocks, as when making purchases of pure stock from breeders they run the risk of purchasing some contagious disease at the same time, which frequently causes terrible mortality amongst what were previously perfectly healthy flocks. It has come under my observation where valuable flocks of good hardy laying fowls have been nearly all lost through the introduction of pure-bred high-priced roosters from diseased flocks."

Mr. Wilson then raises the question of extending veterinary inspection to poultry as well as to cattle and sheep, and asks,—"why should farmers have to run the risk of having their poultry-yards decimated by the purchase of diseased pure stock; the time seems to have arrived when all poultry-fanciers will have to submit to have their yards inspected by a veterinary surgeon, and they ought to seek for such inspection, as with the scare that has been raised in the country about 'buying disease,' the breeder who could produce a clean bill of health for his birds would be certain to obtain the largest number of orders."

In giving this extract, there is no insinuation that the poultry-yards of this Colony are at all affected as those alluded to by Mr. Wilson. Prevention, however, in all cases is better than cure, hence, I advise that fresh stock birds, no matter from what healthy yards, should on arrival be kept apart from the others, for at least a week, so that either latent or recently contracted disease may have time to develop, and thus perhaps save an entire flock from decimation.

CHAPTER II.

THE importance of the poultry industry as a valuable adjunct to the other branches of farming, is at the present day being emphasised throughout all agricultural communities.

The County Councils of England are including it in their agricultural sections; the Board for Agriculture is also giving active encouragement to its development; while the Government Agricultural Department of Canada

has of late years been making practical experiments as to breeds and breeding for the benefit of Agriculturists generally; and, coming to our own Colony, the recent appointment of a poultry instructor to Hawkesbury College, and the acquisition of a large number of all the useful breeds of poultry at this and the other Government Experimental Farms is evidence of the desire of the Department to promote the development of this profitable industry.

James M'Donald, Esq., editor of "Stephen's Book of the Farm," in a recent letter to E. Brown, Esq., F.L.S., poultry lecturer at Munster Dairy School, wrote.—"In farming, the day of small things has assuredly come. Poultry is a subject of the greatest national importance; and is one of the small things which might well contribute in a much greater extent than heretofore to the farmer. To small farmers and cottagers, poultry-keeping is indeed, or ought to be, much more than a small thing. When properly conducted it is a reliable and remunerative source of income, and its reliable character is a consideration of the greatest importance, especially to the poorer class of farmers, who require the entire produce of their holdings for the bare necessaries of life."

The Countess of Aberdeen also lately wrote:—"Lord Aberdeen and I have for a considerable time taken great interest in all efforts to encourage the rearing of poultry amongst tenants and working people. Our experience has demonstrated the truth that it is amongst the agriculturists that poultry-keeping will pay best, if they will give more attention to the breeding, feeding and fattening, which will enable them to obtain a good price in the market."

In commercial undertakings the first and most important point is the question of all others "will it pay?" and when put in connection with poultry-farming the many and numerous failures no doubt justifies the too frequent negative reply. The whole subject, however, hinges on the question "What is poultry-farming?" and when it means a large establishment, devoted solely to the breeding of poultry, the non-success of the business is apparent.

Poultry-breeding, whether as a commercial business or as a hobby, is a most interesting avocation, and may be divided into the following branches:—Poultry-keeping on a large scale as a commercial enterprise; poultry-keeping for farmers as an adjunct to their other items of income; poultry-keeping for town and suburban residents; and poultry-keeping for prizes. The first-named is called poultry-farming, and is understood to mean an establishment where a large number of either pure or common poultry are bred and eggs produced for table purposes only, and where no other stock exists, with the idea that like other special branches of farming, a sufficient annual income will be realised to pay rent, wages, feed, interest on capital, and provide a living for the proprietor and family. This branch of the poultry question has had many special pleader-advocates, however, on paper only. The many attempts to establish such large institutions have all succumbed, energy and capital notwithstanding. The late Secretary of the Royal Agricultural Society of England once pithily put it—"Commercial poultry will only pay as an accessory to something else, whether it be farm or a household."

Whenever eggs and poultry are spoken of as the food supply of a country, France is introduced as the largest producer, and many stories are told of the wonderful poultry farms of that country. It has, however, been conclusively proved that no such establishments exist, and although in the past year over eleven million pounds sterling was realised for poultry and eggs in that country, this enormous amount went into the pockets of peasants, cottagers, farmers, and road-side poultry rearers. Indeed it is a

well-known fact that every householder keeps poultry, which are attended to by the females and youths of the family, the industry being so universal that France is called a country of poultry-keepers.

Poultry-farming, where fowls are the only object in view, and conducted as a separate business, if liable to be charged with all expenses, will rarely, if ever, pay, past experience showing a long record of bitter failures.

Poultry-keeping for prizes is outside the region of this work, but is usually entered upon as a hobby or amusement, the owner's desire being to have good stock, the possession of which tempts him to exhibit at some of the various shows, where they are judged by what is called the standard of perfection for the breed. The competitive spirit is then aroused, other and better birds are purchased, the stock is increased, with the invariable result that the hobby develops into a sort of auxiliary to the owner's business. He advertises his birds and eggs, as do others their various wares, and becomes known by the appellation poultry-fancier.

What fanciers have done for the poultry industry is at present a debatable question. Mr. Tegetmeier, F.Z.S., editor of the poultry department of *The Field*, author of *Profitable Poultry* and other works on the same subject, and a judge of table poultry at the leading English shows, says:—"I have seen with regret, the steadily increasing tendency of poultry shows to encourage mere fancy varieties, and to ignore altogether the profitable value of the birds exhibited. This has gone on to such an extent, that I do not hesitate to affirm, as the result of my experience of half a century, that no one breed of fowls has been taken in hand by the fancier that has not been seriously depreciated as a useful variety of poultry."

Mr. W. Cook, of St. Mary Cray, Kent, a well-known authority and lecturer on poultry, and conductor of the poultry department in *Farm and Field* on the same subject, says:—"The English breeders not only keep good birds but are continually improving them, and these are becoming more plentiful all over the country, but the only grave defect is found in the fact that exhibitors at our shows are apt to sacrifice the laying qualities to fine feathers and good points. Thus oftentimes a good breed is spoiled, because in the eagerness to produce fine plumage, &c., the most important qualities from a commercial point of view are lost sight of."

The following extract is from Mr. Consul Gurney's Report for the year 1895, on the agriculture of the Cherbourg district (France), which was presented to both Houses of the British Parliament in May last year:—"The agriculturists of Western Normandy having given up cereals, now get a very fair return for their capital and labour out of dairy-farming, poultry-rearing, and market-gardening, and London furnishes them with a profitable market for their butter, turkeys, geese, and poultry. Their fowls are carefully tended, and, having the free run of the grazing fields and the cider apple orchards surrounding the farmstead, add largely to the profits of the farm. Fostered by shows which are based upon the fallacious principle of breeding for feather only, a grievous mistake from a practical point of view, poultry-keeping in England has become too much of a fancy, benefiting only prize-winners and opportunist poultry-breeders catering for the newest fad in shape and colour."

The above are certainly grave charges, and coming from such prominent authorities, have never been seriously challenged; still there are others just as loud in their protestations in favour of the great benefits resulting from competitive exhibitions. However, those outside the warmth of dispute and

debate can take an impartial view of the results, and will readily grant that fanciers have certainly much benefited poultry-keepers by improving some breeds in the way of size, and also producing new varieties of much value from a commercial point of view, while their attainments in others have been but the production of feathers, spangled, pencilled, and laced, combs of all the various shapes, excess of fluff and foot feathers, wide cushions, and legs of various hues, many of the points being arbitrary, and no proof of the purity of the breeds. The aim of the fancier is to breed fowls to suit show-pen requirements, and win prizes, and thus assist him to dispose of his stock at big prices. The purchaser expecting a like profitable return by the same process, the breeding of these birds for fancy points is certainly an interesting amusement and instructive occupation, and the pity is that the utility question has been relegated to the back ground.

CHAPTER III.

Poultry-keeping for farmers is the principal branch of the above subject, and can be entered upon in quite a cheerful spirit, it being one of the small things which they neglect, and which, if attended to in the proper way, would mean a much improved balance-sheet. Indeed, of the many small things which farmers should take an interest in and don't, poultry is the principal. Farmers have all the elements of success in their surroundings, and everything necessary for the well-being of poultry, but appear to think they are too small a matter to trouble about.

Fowls on a farm, or in a farm-yard, and having a free range, get the largest portion of their food for nothing, or at the very smallest cost, while small corn, undersized potatoes, and other waste products can be most profitably utilised. There is no cost for labour, nor charge for rent or buildings, and for these reasons alone fowls will not only pay, but pay well.

France, which leads the way as a poultry-producing country, depends entirely on its cottagers and small farmers for the supply, separate poultry establishments being unknown. Edward Brown, Esq., F.L.S., in his work on the same subject, says:—"The French farmer needs no one to impress upon him the advantages to be derived from poultry-keeping. In his rural schools he is taught the principles of this and allied subjects. If he goes to an agricultural college, what he already knows is emphasised and corrected, and he has the constant example before him of those who find their largest and surest source of income from the fowls reared and eggs produced upon their farms."

While the English agriculturists, realising that the staple industries of the farm can no longer be relied upon to give them a profitable return, are of late years, in many counties, making the cultivation of poultry part of the work of their farms, and with gratifying results. Coming to the industry in Australia, a few visits to the city centres where such are sold will soon bring conviction that poultry on the farms or elsewhere are for quantity most abundant, but the vast majority of such are low-conditioned, worthless, and frequently diseased specimens, and would fail to find purchasers outside the capitals of Australia; indeed the thousands of fowls which weekly reach the Sydney sale-yards is conclusive evidence that poultry-breeding is carried on by a large majority of farmers and other householders of the Colony, and

although the prices obtainable are apparently nominal, still such prices must be paying ones, otherwise the breeding would be discontinued. If the present prices do pay the producer, my purpose is to show that with the proper stock and attention, together with that other neglected essential, a liberal food supply, the breeder will realise double the price for his stock, and be able to market them at a much earlier age, the advantages of the liberal feeding system being such that, independent of the enhanced price obtainable for the young and meaty carcase over that of the old and lean, three broods can be reared and marketed in the same number of weeks as was occupied by two broods under the old system of inattention and neglect.

With such a character for quality of the Sydney poultry as I have mentioned, and with which the majority of those interested will agree, it appears to me most strange the many and frequent inquiries and discussions which have of late taken place relative to the best breeds for export, and although more immediately interested in the export than in the local trade, my invariable reply has been that only the best quality poultry—*i.e.*, young and meaty birds—are at all suitable for the home trade, and that when such are obtained there is a good paying market for them in Sydney; indeed, I have been informed by the leading poulterers in the city, that frequently they have orders for first-class goods, and are prepared to pay breeders own price, but the quality is unobtainable. It may be retorted that to produce good birds better stock is required. This, however, is only partially correct. To produce really first-class table-poultry to command the top English prices good stock birds are, of course, an important element; but were I to recommend the disposal of all the common poultry in the country in favour of pure-breds, and were such recommendation adopted, it would cause a revolution in the poultry industry which the results would fail to warrant. Pure-bred birds, although to be recommended for producing the best table-poultry, are not an indispensable essential, and when farmers and other poultry-keepers, by good housing, feeding, and other up-to-date methods, have made the best of the common fowls in their possession, it will be quite time enough to discard such in favour of pure breeds. And in connection with this same subject I should mention that over 80 per cent. of the table-poultry put on the London markets are what are described as barn-door fowls, *i.e.*, mongrels, the remaining 20 per cent. being Surreys, crossbreds, and pure breeds; and even the famed Surrey fowls are not always native bred, in either that or any other English county, vast numbers of them being brought weekly from Ireland, to be fattened in those counties, and sold in the London markets as Surrey or Sussex fowls—another proof, were such wanted, that it is not a matter of breed so much as an improved system of poultry-keeping.

Whatever way we look at the subject we must come to the conclusion that the agriculturist of all others is the man who can and should make poultry a profitable undertaking. He has the land and the labour within his own family, cheap food, while a very small capital only is required. Indeed, poultry-farming on a farm can be carried on at a minimum of cost; nor is this theoretically speaking, for I am aware of more than one poultry-farmer who became such from the force of circumstances, and being unable to obtain a living from what heretofore was called the staple products of the farm, are now making this new and interesting branch of their work a paying one, resulting from better methods of management, better breeds, and an improved system of putting their stock on the markets, the neglect of any of these essentials much lessening the profit. Of course, when the agriculturist is a considerable distance from the market he is at a disadvantage

compared with those nearer the centre of distribution; but as it requires no more to convey a good chicken to the market than a bad one, the difference between that received for the fat and the lean will be so much more profit, and as the breeder was able to make it pay under the old system of neglect, how much more profitable should the business be when conducted in a practical and systematic manner.

Chapter IV.

Eggs.

Whatever the profitable advantages of an improved system of poultry-keeping on the farm may be, the vagaries of the Sydney markets afford an index to the vast possibilities of improved methods in breeding for eggs. The English market for such extends from 6d. per dozen in the spring and early summer months to a shilling in mild winter, or a maximum of 1s. 2d. in severe seasons; speaking generally, the winter price being double that of the summer. Coming, however, to our own Colony, with a winter climate almost equal to that of an English summer, and most favourable for a prolific egg supply, what a change presents itself. Instead of our top winter prices being double that of the summer, as in England, the actual facts are that for many winter months, the market price, whether wholesale or retail, is 400 per cent. higher than that obtainable in the plentiest season, the 4½d. and 5d. per dozen of October and November running up to a couple of shillings in April and May, the average price for March, April, May, and the early part of June of the present year being slightly over 1s. 8d. per dozen. The price is the best evidence that the supply is a very meagre one, and carries on the face of it a reproach to the cottagers and farmers who should be able to put large quantities of eggs on the market throughout all seasons of the year; for the inattention and general loose methods of poultry-breeding for table purposes is still more intensified when egg production is in question; and should such a state of affairs exist, I have not a doubt but that some of the wide-awake English or other exporters will take advantage of our neglect, watch our markets, and before we know, land consignments of English eggs during the months mentioned; which would be one of the safest possible speculations, even allowing for the inevitable fall in prices that such importations would involve. English eggs can be landed in Australia during the months of May and June, and if sold at 1s. a dozen would return a good profit, and should our unsatisfactory system of poultry-breeding continue as in the past, breeders may awake too late to the fact, that while breeding for eggs in summer scarcely pays, the imported article has so lowered the winter price as to make it a like unprofitable one. The whole question of breeding for an egg supply after having the proper stock is a mere matter of the regulating of the hatching season, so that the young stock will be coming on to lay when prices are at their best. It is not so much the number of eggs a hen lays, the time they are laid is the one important point for consideration. A hen that lays 150 eggs a year—the majority of which are laid in the six months beginning with August—is of far less value than the one that can only claim 100 as her yearly limit, when this hundred are available in March, April, May, and June; and that these are attainable, I shall in another chapter attempt to show.

Chapter V.

Selection of Stock.

In selecting either fowls or animals for breeding, a most important matter is consideration of the work which they have to do, for on the selection and mating may depend the future profit or loss; and in connection with poultry there is no stock which show such variations between the breeds, as well as marked differences between individual members of the same breed, due to the varied conditions under which they are kept.

To begin with, therefore, I should say that the male bird influences the shape, external structure, and general outward appearance. Hence, it is the cock bird we must look to when we require a large size of frame, it being a too well-known fact that a small male bird seldom breeds large ones. The hen, on the other hand, generally controls the habits, temper, internal structure, vital organs, and constitution. So a good layer will invariably produce good layers; a quick fattener will produce those of the same characteristic, if properly mated; while a hen who is a good mother transmits the same virtue to her progeny, a bad layer never produces a better bird than herself.

The first point in choosing stock for the breeding of good table-poultry is that the birds should have a frame suited to carry a large quantity of meat on the proper place, and be quick growers and easily fattened. A bird to meet these requirements must have a long, square body, long and deep breast bone, deep in keel and broad in breast, clean and short legs being also an important factor. All authorities also agree on the point that coarse-legged, heavy-boned fowls should be avoided, for it is too well known that the best meat on a fowl is that found on the breast, and it is this we wish to produce. The legs of a fowl are largely composed of sinews, and the meat inferior, and this, of course, we must avoid producing. Like the male birds, the hens for producing good market poultry should be deep in keel, of heavy build, short and free from feathers on leg. In choosing a cock for breeding purposes, when the chickens are intended for a good laying strain, it is important that we get a good sized, shapely bird, active, close feathered, and one that handles well; a bird of this sort should be mated to hens of proved laying qualities, deformed and badly-shaped birds being avoided in all breeding stock, their defects being usually intensified in the progeny. As previously stated, the aim of the poultry-fancier and exhibitor has been to specially breed to improve the outward appearance of the fowls, at the expense of utility, consequently it has been found that the poultry-keeper whose object is profit must have resource to the now much-advocated system of crossing, the result being much more satisfactory than if he had confined himself to the deteriorated pure breeds. The re-crossing of various suitable breeds gives most excellent results, the progeny being usually better layers, or better table fowls, or both; but when this crossing is persisted in without reason or order, the beneficial results soon disappear. This can be better realised by the fact that a pure-bred cock of an approved breed, introduced into a yard of common fowls, will, in a single season, most wonderfully improve them; but should this cock be of the first cross himself, of even the best breeds, his introduction will have little effect for good. To make the benefits lasting, the introduction of new blood must be continuous, and consistently done. The farmer by a judicious selection from his stock may, in a short time, have a strain of poultry, whether for eggs or table purposes, which will repay him a hundred-fold for a small outlay, for to be successful in the undertaking it is important to be in possession of a strain of fowls

that are of a hardy robust constitution, that will grow fast, mature early, feather quickly, and at an early age have bodies and breasts well furnished with good flesh. To procure birds of this description it is impossible to purchase them. They must and can be bred, and the foundations for the building up of such a strain can be found in the detailed list of breeds in the following chapters, which gives their different characteristics, the various purposes for which they are best suited, and general adaptabilities.

Chapter VI.

Asiatic Breeds.—Cochins.

This variety, on their introduction into England, now about fifty years ago, had the honor of giving the first great impulse to poultry-breeding, and created more excitement than has any variety since. They were regarded as something wonderful in the poultry world. Their praises were sung far and wide, and fabulous prices paid for eggs and birds; and were for a time called the kings of the poultry yards. Like many later day varieties, however, which were unduly boomed, when weighed in the commercial balance they were found wanting, and have long since "taken a back seat." Cochins were first exhibited in 1850, and although many exaggerated stories were told of their "wonderful qualities," still they were then good layers, one authenticated record being of five hens which laid a hundred and twenty eggs each per annum. The breed also did much good in increasing the size of the fowls then in the country, but there is a general acknowledgement that the quality much suffered. Whatever merits Cochins had when introduced such has now been lost, the opponents of the fancy attributing the deterioration to the breeding for the show pen. Cochins are now valued in proportion to their shape; abundant feathering on body, legs, and thighs; pureness of the white in whites; richness of the sheen in blacks; evenness of the colour in buffs; and regularity and richness of pencilling in the partridge; they must have neat combs, small tails, high cushions, and plenty of foot feathering. In matters pertaining to poultry, Australia, as in most other things, faithfully follows the fashion set in the old country; consequently when a craze arises over an old breed, or a new variety is boomed irrespective of its merits, sooner or later a like rush takes place here, and in no other breeds did Australians so unreasonably follow their leaders as in the variety under discussion; the classification at the leading shows was most extensive, its patrons were many; the exhibits exceeded that of any other breed; while the special prizes and cups offered for its encouragement were far in excess of all other varieties. The excitement over the Cochins was such that the writer was engaged to go to another colony to make the first award of a fifty guinea cup, the only one of this value ever offered for this or any kind of poultry in the colonies. The breed was then in the zenith of its popularity, and the exhibits numbered over a couple of hundred. However, their commercial worth was soon found out, with the result that every year since they have been rapidly on the decline, the total number catalogued at the same society's show this year being under three entries a class. As table-poultry they are now about the worst variety we have, either as pure or for crossing. There is very little meat on the breast, while the breast bone is prominent, except in old specimens. They certainly have a lot of meat on the legs and thighs, but this is a bad place for such, and is no recommendation. A good table fowl should have a breast bone capable of carrying plenty of meat, which

the Cochin has not; internal fat being another unfavourable characteristic. Cochins, whether for crossing with ordinary farm poultry or pure breeds, are not to be recommended, the progeny being lanky, angular, big-boned, and are difficult to fatten; the flesh is both coarse and yellow. Cochins in the various colours are inveterate sitters, big eaters, bad layers, and altogether unsuited for those who wish to keep poultry for profit.

Brahmas.

It is no part of my duty to enter into the still disputed question of the origin and purity of this variety; suffice to say we have them, and the present show-pen standard of either the lights or darks is certainly for handsome appearance a triumph of the fanciers art. Small round heads, neat triple combs, profuse leg and foot feather are important points in the breeds. In lights the hackle of pure white should be striped with dense black in both sexes, black tails, and black with white in the foot feathers, the rest of the body pure white. In darks the pencilling of every feather is of much importance in the hens. The ground colour of the feather is grey, pencilled with a darker shade of the same colour. They are a large-sized fowl, with short wide back, breasts full, wide, and deep, the breast-bone coming well down between the thighs, and legs a moderate length. For many years Brahmas were a great favourite in the show-pen. The leading English fanciers' societies up to recently offering larger prize money for this variety than any scheduled in their show. The offering of large prizes and cups secured the desired effect, viz., correctness of colour, pencilling and other markings, with abundant fluff; but at what a cost? The brahmas long enjoyed the distinction of being the farmers' fowls, on account of their great size and good laying qualities, and far from bad table properties; but these qualities generally speaking have been lost in the rage for outward appearance. The deterioration of the useful qualities is also evidenced by its unpopularity in the fanciers' shows, both in the old country and in the colonies, and nowhere more marked than at the leading exhibitions of this Colony and that of Victoria, the couple of hundred exhibits of this breed a few years ago being now reduced to about two dozen, the public showing their good sense by going in largely for the more useful varieties. Brahma-breeders some few years ago were very numerous in New South Wales, but later day unpopularity has reduced their patrons to under half-a-dozen.

Brahmas do well in confinement, being hardy, and not much given to disease. Their eggs are brown but not large. The hens often go broody. They however make good sitters and mothers; and for those who keep non-sitting varieties, brahmas will supply them with broody hens. As a market fowl they cannot be recommended, they have little meat on breast, with much on thighs, and rather coarse heavy legs. However, they cross well; a large sized Dorking cock mated to half-a-dozen sparsely feathered Brahma hens, will produce excellent table fowls, the chickens will be found to be strong and hardy, and at six months old will realise good prices any season of the year in our local market. The pullets will make excellent stock birds, and commence to lay at seven or eight months old, hence, if hatched in July or August, there will be a full egg supply in March, April, and May; and as one egg in these months is worth three in the summer the advantages of early hatching will be apparent.

At the late Dairy Show, held at the Agricultural Hall, London, in a class for table-poultry, "two pullets of any cross," Lady De Rothschild won first prize with a pair of Brahma-Dorkings, five and a half months old, in a class

of fourteen entries, beating Indian game, Rocks, and other crosses of seven months, the same cross getting second prize in a class of twenty-six cockerels.

Orpingtons, Game, and Houdans, also cross well with this variety, the particulars of which will be noted when dealing with these breeds.

In a lecture given by the late Alexander Comyns, one of England's practical poultry experts, the statement was made that a Brahma cock with Houdan hens produced the best table-poultry he ever saw, the birds being plump, white-fleshed, and bones small. Houdans, however, being so very scarce in Australia we need not look for satisfactory results from that quarter.

Chapter VII.

General Purpose Fowls.—Langshans.

Possibly no other variety of poultry has received such prominence for a continuity of years, through dispute and discussion as to purity and type, as has the Langshan, and to say that such is over would be to anticipate too much, seeing that there have been frequent lulls in the controversy, with the inevitable revival; now however, that a type has been fixed, approved of, put into force by the judges, and acknowledged by the breeders generally, we may at least hope for a finality in Langshan literature and look for the results.

The breed in Australia, for a number of years, has been a favourite one, and although never unduly boomed, very high numbers have been recorded in the best New South Wales and Victorian shows; indeed, some two or three years ago, when at their height of popularity, I wrote, "that however valuable Langshans were as a breed of fowls, the then rage was not justified," and their decline in popularity has been as then predicted. Langshans are usually described as a good all round fowl, that is, although good layers, and of useful table quality, they do not stand out or excel in either of these. They are now bred long in leg, tight in feather, sparsely feathered on the leg, neat combs and moderate tails, black legs, with white flesh, and layers of good sized brown eggs. They are hardy, good sitters and mothers; do well in confinement, but either for local market or export are rather slow in developing, thus debarring them from first place for either purpose. For birds of large frame, the chickens are rather bare of breast meat. The full benefit cannot be had from them until seven or eight months old, and although they are then like young turkeys it would be questionable whether the price obtainable would pay the breeder for the thirty weeks' feed; but as a fowl for home consumption, and killed at the age mentioned, they cannot be excelled, while for improving the table qualities of Minorcas they have many advocates, but never having had any experience of the cross, I cannot give results.

The poultry expert at Hawkesbury College, in an article in a late issue of the *Agricultural Gazette*, wrote that Minorcas and Langshans were two good breeds to cross, the progeny being good layers and market birds; and as Mr. M'Cue is no theorist, I feel sure the result of such an alliance will soon be in evidence at the College poultry yards.

At the English Dairy Show some six years ago, when prizes were given for weight rather than quality, Dorking-Langshans won first and Game-Dorkings second. A few enthusiasts, however, practically tested the prize

birds when dead, and found that the Langshan cross lost by drawing and trussing twenty ounces, or a fourth of its entire weight; the Game-Dorking cross lost but fifteen ounces in offal, thus proving that the weight of the Langshan cross was more apparent than real; and in a report on the subject one authority states that we may get large, hardy, and useful chickens for the family from a Langshan cross, but it would not produce a first class table fowl for the market. In spite of this, I am of opinion that they can be usefully employed in the improvement of the poultry of the farm yard, but I prefer those of shorter build than the present exhibition specimens.

Orpingtons.

Of the numerous new breeds which have been introduced into the poultry world, none have taken such a hold as the variety with the above title. Some ten years ago they were first issued to the public by Mr. W. Cook, of Tower House, Orpington, Kent, whose claim for the breed was that it supplied the long-felt want in the poultry world, viz., a breed with the combined qualities of an exceptional layer and all requisites of a first-class table fowl. When introducing the breed, Mr. Cook candidly informed the public of its component parts, and one of the varieties used in the manufacture being an unpopular one, was no doubt largely responsible for a host of ill things said of them during the first two or three years of their existence. Those, however, who tried the variety and tested it on its merits, spoke most favourably of the many qualities of the breed, not one of which had been overstated by its originator. They are bred in blacks, whites, and buffs, of both single and rose combs. The single-combed blacks are the most popular. The colour is glossy black right through in both sexes, with upright combs. They have large deep bodies, with long breasts, and deep in keel, short black legs, and carry a fine quality of white flesh.

The variety was not very long introduced into England until it reached these shores, its success being unparalleled by any other breed in the same time; the show-pen record for numbers being held for this variety, while its non-exhibiting patrons outnumber several of the other breeds combined.

Poultry-breeders for market purposes have tried the variety with great success, resulting in the discarding of other varieties in their favour. Mr. Cook, well-knowing the injury done other breeds by judging them for appearance only, and fearing a like ill-effect on this his own breed, gives the following warning and advice:—"The Orpington hen combs may fall over a little on one side. The large combs denote good laying qualities. This also means that the best laying fowls have to be sacrificed, because their combs are large, and the judge passes them over, and thus destroys the utility of the breed. Poultry societies should award prizes to those which are capable of laying the largest number of eggs in a given time. If judges would but study the laying qualities and general shape of the fowls, and not spend their time in judging the plumage, it would be more beneficial to poultry keepers at large."

As layers, in both winter and summer, of large brown eggs, this breed is justly celebrated; many poultry-breeders who keep several sorts of fowls asserting that they had a continuous supply of eggs right through the winter from the Orpingtons, when not one of the other breeds were laying an egg. The pullets have been known to commence laying at five and a half months old. They shortly go broody, but soon begin laying again, and continue for several months; the eggs from the second laying being of a good marketable size.

The breed suits almost any climate or condition; they do well in either confined yards or free range; the chickens are hardy, feather quickly, grow fast, and, when suitably fed, are always in killing condition, and at five months old will weigh from four and three-quarters to five and a-half pounds, hence for either local market or export purposes they are most admirably adapted. With a variety for which so many excellencies are claimed there should be no need to recommend crossing, as the advantages are not apparent. They have, however, been largely resorted to to improve farmers' poultry.

The best system to adopt is to kill off all the common cocks and cockerels, as well as all hens over two years old, and then introduce a big-bodied, short-legged cockerel to about every dozen hens, and when this is repeated two or three years in succession, each year new cockerels used, the common poultry will generally have become a uniform black colour, while the laying and table properties will have undergone a change from unremunerative to profitable poultry culture.

Buffs and whites are of such recent introduction to the colonies that any statement regarding their merits would be but the opinions of the few interested breeders, and might possibly be changed more or less favourably when these colours become more plentiful. The blacks, however, meet all requirements, and being so numerous, there is no need to purchase related or inbred stock.

Plymouth Rocks.

Varieties or breeds of poultry have, like some animals and flowers, on introduction been the subject of a boom or craze, and of recent years none more so than Plymouth Rocks. The show-pen records of this variety for numbers half-a-dozen years ago exceeded that of any other breed: the reputed laying properties, table qualities, and size, combined with a handsome appearance, stamped them as the best all-round fowls, and the colonies, always eager to emulate the mother country, rushed them to such an extent that for some years the value of the importations from England was much in excess of any other breed. Both fanciers and ordinary poultry-breeders got smitten with what was then called the "Rock Fever," abandoning older breeds of tested utility in their favour. However, in two or three seasons the crisis was reached, with the natural result that they rapidly declined in public favour, and now only occupy a third or fourth rate place with practical poultry-keepers. Good exhibition specimens are found in but few fanciers' hands now, while the numbers exhibited at our shows are only about the fourth of what they were a few years ago, newer varieties superseding them. In spite, however, of this decadence, Plymouth Rocks have many good qualities. They are very hardy, stand damp, cold, and confinement well. They are good sitters and mothers, the chickens are easily reared, feather quickly, and are not much given to disease.

The majority of those who have given the breed up pronounce them as rather poor layers of eggs, which are small in proportion to the size of the fowls. The hens are much inclined to lay on fat, which no doubt affects their laying properties. The ordinary blue-barred Plymouth Rock is too well known to be here described, and of late years a white has been produced with but little hope of a successful future. Those who wish to breed poultry for home consumption, and can afford to keep the chickens until seven or eight months old, will find the Rocks an excellent variety to keep. The cockerels and pullets of this age, if well fed and otherwise cared for, will be very large and meaty, one bird alone being sufficient for a good

family dinner; but for the local or export market they cannot be highly recommended, for, being fowls of a large frame, they are slower in developing than several other varieties, and, consequently, more expense is involved in bringing them to a marketable condition.

A large sized Plymouth Rock cockerel, of from ten to twelve months old, can be used to great advantage to much improve farmers' common poultry, or even to mate with first crosses for table-poultry. At the last Dairy Show in the Agricultural Hall, London, a pair of cockerels bred from Plymouth Rocks and cross-breds, and but four and a half months old, got second prize in a big class of twenty-five entries, beating many crosses noted for table properties. Plymouth Rocks also cross well with Brahmas; the majority of the chickens being Rock colour and will grow to a great size, chickens from this cross frequently reaching 7 lbs. weight at eight months old.

Wyandottes.

Wyandottes, like the Rock, were made in America, and, like that breed, have taken on well, being now one of the popular varieties, and bidding fair to exceed in success anything in the poultry way yet invented by our cousins. Indeed, the qualities which have, so far, brought it into public estimation will contribute to make it a lasting one, not with fanciers only, but, more important still, with practical poultry-keepers, viz., farmers, orchardists, and cottagers.

Unlike the Rocks, they were never rushed, but gradually found favour, and there is now little doubt of the permanency of their popularity. They are bred in what are called gold and silver-laced and whites, the laced varieties finding most favour. In general appearance, they have a short arched neck, full hackle, short legs and back, and prominent breasts. As viewed beside other full-feathered breeds they may look small, but when handled, or even better, weighed, their bulk will be more apparent, which possibly accounts for them being frequently alluded to as "the big little fowls." Taking them as layers the general opinion is that they are excellent; indeed for the quantity of eggs few breeds equal them, and were the eggs somewhat larger I know of few breeds to excel them. As table fowls I have heard them condemned on account of their yellow legs, the theorists running away with the idea that this is always an accompaniment of yellow flesh, but such is not the case, the large majority of the silvers being as white in the skin and flesh as either the Langshans or Orpingtons. The hens make good sitters, careful mothers, and commence to lay again when the chickens are three to four weeks old. The chickens are hardy, feather early, develop quickly, are good foragers, and are always fat enough to kill at any age from 12 weeks, and at four months old should weigh from four to four and three-quarter pounds each; hence, if hatched in August and September, these ages and weights, which suit the home markets, will be attained in January and February, enabling them to be landed in England, when prices are highest, owing to the scarcity of the home and foreign supply. Wyandottes are now very plentiful, can be purchased moderately, and possessing the characteristics mentioned, there seems neither need nor advantage to cross. At the show previously referred to, in the class for pure-bred table poultry other than Dorking or Indian game, Silver Wyandottes won against 12 other exhibits, which included Rocks, Langshans, Orpintons, and Houdans. The same variety also won in the pullet class, beating the above varieties as well as British game.

Chapter VIII.

Table Poultry.—Game.

The game fowl, or old English game of half a century ago, in appearance, far excelled that of any then known variety, whether as regards its elegant form, graceful and majestic carriage, bold, proud, and courageous bearing or brilliancy of its plumage, and was often likened to the other breeds of poultry as the racehorse among horses, or the greyhound among dogs. The form was elegant in outline, and perfectly symmetrical in every part, with a small head, fine comb (before dubbing), eye large, full, and bright, bill short, breast ample and broad, wings strong, and drooping towards the ground, projecting rather behind the body, thighs strong, the neck and saddle-hackles large and abundant, and shoulders broad. As table-fowls they were not of the largest, but the flesh was of the most beautiful whiteness, and superior to that of all other breeds of domestic fowls for the fineness of its fibre, and richness and delicacy of its flavour. The era of the show-pen, however, has changed all the above characteristics, the past 30 years being a continuous evolution from all the qualities calculated to show courage, to what a celebrated present day writer is pleased to describe them now as "approaching the elongated waders of the ornithologist"; nor can they now be tested by the standard of practical merit as they once were, and can be regarded as ornamental fowls only, and like them have become delicate and difficult to rear, and are neglected by those who breed for practical purposes, they being unfitted to assist in supplying the market with either table-poultry or eggs.

This great lapse from their one-time prestige has of late years been much in evidence among practical poultry producers of the Old Country, who recollecting the breed's one-time economic qualities, by offering large prizes at the best shows for what they rightly term "Old English Game," with the gratifying result that the plump, close-feathered, short-legged, rich and delicate flavoured, fine-fleshed fowl of fighting memory is now fast approaching pride of place for popularity amongst the many old and new breeds bidding for such claim; and although only recently reinstated in the great London Dairy Show Schedule, at the last exhibition of that society the Old English exceeded in numbers the Game which have been annually catalogued for the past twenty years. During the years that British Game were being bred chiefly for show-pen excellence, and losing economic qualities, the practical men of Devon and Cornwall were producing a breed with useful qualities, calculated to supply those lost in the extinction of the Old English, and succeeded in every way, the name only being unfortunate—*i.e.*, Indian-Game. Malay, English Game, with some Azael blood, are the acknowledged component parts of this variety, which has become most popular, is largely exhibited, and ranks as a most valuable fowl, whether for breeding pure or crossing with various other breeds. The Indian or Cornish Game may be roughly described as a short-legged, short-necked Malay, with a less cruel-looking head and more pleasant form than that variety, the general conformation embodying all the characteristics considered essential for high-class table-poultry. The colour of the cocks is green glossy black, with crimson shaft in the hackle feathers. The ground colour of the hen is chestnut brown, with rich black lacing on each feather; the head of both sexes rather long and thickish, the wattles small, neck medium length, and arched; body thick, compact, and broad at shoulders; back flat; breasts wide, deep, plump, and meaty; legs strong, but much shorter than the Malay. Possibly

never since the Cochin fever of half a century ago did any breed take such a hold of the English poultry world as did this breed. The Americans also rushed it to such an extent a few years ago, that one vessel actually conveyed over 1,000 birds from England. About the same time the writer landed the first trio of this breed in New South Wales, and then predicted for the breed a boom in Australia, no other variety ever taking such a hold of Australian breeders in the very few years since their introduction. The first two hens (the property of a Newcastle gentleman) exhibited in Australia was at the N.S.W. Poultry and Pigeon Show, in 1890; the records for the present year coming well nigh to any other variety.

My purpose thus lengthily referring to this breed is to emphasise the fact that the popularity has been solely due to their undoubted reputation as table-fowls. And whether they retain this popularity depends solely on the breeders and judges of the variety; and from what I have already seen here, and the latest English information, there are grave doubts on the subject.

Mr. Tegetmeier, whom I have already quoted, says:—"It has recently come into fashion as an exhibition fowl, and, in consequence, has become better known; but the circumstance has not been without its more serious drawbacks. Indian-Game, as now exhibited, are judged, not for their economic value, their short legs, plump breasts, with abundant meat, but from their markings. To win prizes at competitive shows, hens must have laced or margin feathers. The result of this breeding to fancy points is that the show Indian-Game are now bred for their laced feathers, plumpness and table qualities being ignored." What this eminent authority wrote of the breeds at the English shows four years ago applies with equal force to those of this Colony, the useful qualities of the birds being sacrificed in favour of colour-lacing and other show-pen requirements. The two leading shows of the Colony, the present being testimony thereof, one of which had the very large number of forty-four hens and pullets of this breed catalogued, only fourteen of them having standard requirements sufficient to receive recognition from the judge. The majority of the unnoticed specimens had great size, good shape, condition, and other essentials embodying every useful quality. Another Society's show had some sixty-six birds of both sexes, over forty of this number failing to reach the arbitrary standard demands, while, for economic purposes, many of these were superior to the prize-winners. Still, admitting all their great merits as table-fowls, I am, for various reasons, obliged to consider that they have now reached the height of their popularity. The great difficulty experienced in breeding exhibition specimens, and being but moderate layers, are handicaps which I fear will prevent them further increasing in public favour, and for these reasons are unprofitable to breed in a large way, but for crossing with other sorts for prime market poultry they are most valuable. A short-legged, big-bodied Indian Game cock mated to Dorking hens will produce table fowls of the very first rank; they will have the proper quality as well as quantity of breast meat, no matter at what age killed. It should, however, be observed here that neither of these varieties are considered good layers, and, however valuable the progeny may be for its table qualities as stock birds, for an egg supply they cannot be recommended. But to get the full benefit of the cross as a table fowl and egg producer, a most excellent system will be to kill off all the Indian-game-Dorking cockerels, and mate the pullets with Houdan or Orpington cocks, and the result from these will be satisfactory in every particular. As stated in a previous chapter, to cross fowls for the greatest profit the crossing must be consistent and continuous; hence the cross-bred pullets from the Houdan or Orpington

must be mated back to a Dorking cock, and the produce of these back to an Indian Game, using the three breeds alternately each year. With a system such as mentioned, and no hens kept over two and a half years, the egg supply will be more than twice of that from any ordinary collection of farm-yard fowls, the chickens admirably suiting either our local markets or export purposes. Indian Game also cross well with Orpingtons and Langshans, the progeny of the latter are longer developing than that of the former, consequently more suitable for local than export trade; youth and fine quality being an English essential rather than great size.

Colonial Game.

While the Cornish miners of some thirty years ago were building up a fighting Game cock to take the place of the old English, and from which evolved the present Indian Game, a remarkable coincidence is the fact, that about the same time exactly the same process was going on in the Hawkesbury district of this Colony, the breeds used by the old cockers for the required purpose being almost identical with those used by the Cornishmen. Both parties were working for the common end, namely, good fighting birds, little thinking that a fancier's or show fowl would be the ultimate result of their labours. One great difference between the Hawkesbury and Cornish evolutions is that regarding colour; the birds produced by the miners is a new colour to the fancy, while the Hawkesbury men followed strictly the line of the British Game, producing their favourites in Black-reds, Duckwing, Piles, Brown-reds, Whites, and Blacks. So far as the general build of the bird is concerned, a few years ago the Colonial or Australian Game and those known as Indians were very much alike, large-bodied, strong in bone, hard and close in feather, and carrying a great amount of flesh on the breast; the breed has become a very popular one in this Colony, over one hundred pens frequently appearing at the shows of the N. S. W. Poultry and Dog Societies. Of late years, however, the craze for breeding long legs and giraffe necks on game fowls has been adopted by fanciers of Australian Game, short limbed specimens having now no chance for show-pen honors, with a natural but sorrowful result of a decline in popularity, and what for its many grand qualities promised to supply a want of a large well-fleshed game fowl, as a foundation for table poultry, has for this cause alone received a back set in favour of the imported Cornishers with not a single superior quality. Australian Game are now bred to a great size, 10½ and 11 pounds being no unusual weight for cocks, the hens going to 8 pounds or more. As table fowls they are really excellent in every particular, but like all other breeds that excel in this quality are not prolific layers. Of the many varieties we have, perhaps there is none better fitted to breed pure for either the local or export trade, the chickens like all game are always in killing condition, and at sixteen to twenty weeks are well suited for either the Sydney or London markets. At the last Bathurst Show for the Government prize for poultry fit for export Colonial Game chickens won, the report on the exhibits being worth reproducing here. "The birds had long breasts with great depth, carrying a wealth of meat rarely seen on any other variety, and of the much desired white or pale primrose colour."

Colonial Game I consider in every way fitted to supply the market with table poultry, and this can be done either by breeding pure, by crossing with other varieties, or by using them to improve the ordinary farm-yard poultry of the Colony. Any of the various colours will do, preference being given to the pure blacks, they being more as the cockers left them, short-necked, short-limbed, wide-shouldered, big-bodied birds, and of great hardiness.

Dorkings.

Of the many and varied breeds of poultry new and old, the Dorking stands out as eminently an English fowl, and has for many years been the basis of the best table poultry for the London markets. Whenever English table poultry is spoken of Surrey and Sussex fowls are always introduced, and it is in conjunction with the Dorking that the qualities of these are so much appreciated. Dorkings are bred in four colours, viz., darks, silver-greys, whites, and cuckoo; the latter colour is unknown in Australia, whites were for a number of years bred, but have of late disappeared. The silver and darks are of much the greater size; and whatever the correctness of the charge against poultry fanciers for spoiling some breeds, little can be brought against them in respect to Dorkings. Mr. Tegetmeier—whom I have referred to as an opponent of poultry exhibitions as at present conducted for outward appearance only—admits that fanciers have much increased the Dorking's size, but asserts as a set-off that it has been at the expense of fine bone and loss of flesh quality. He maintains that coarse bone, particularly on the shank, is not consistent with the best flesh. One most essential point in all Dorkings, whether for the show-pen or table, is white feet and legs; while another for the show-pen is the fifth toe as a distinguishing trait of the breed. Dorkings are much given to an ailment known as bumblefoot, some people associating it with the fifth toe, while others consider the affection a consequence of the heavy weights of the breed. Dorkings have large square deep bodies, deep breasts, with short legs and feet, a conformation in every way suited for carrying a large amount of flesh. Although many first-class specimens of this breed have been imported to this Colony they have not flourished, one prominent breeder's success notwithstanding. There has always been much difficulty in rearing the chickens, but once over six weeks they seem as hardy as any other breed. Dorkings are understood to do best on a dry soil; but it is a well-known fact that both the Irish and Scotch exhibitors of this breed have for many years beaten the English breeders at the best old country shows, and we know that neither country is of the driest. Dorkings require fresh blood introduced oftener than other breeds, the neglect of this being that the birds get smaller and more delicate each year. This, as the majority of the colonial birds are more or less related, probably accounts for the difficulty in bringing them up. As steady sitters and good mothers, Dorkings are of surpassing excellence; and for table use, they are unquestionably superior to all other breeds, for although they may not excel the game in delicacy, they surpass them in the quality of the meat, and that, too, of beautiful whiteness and richness of flavour. The qualities of Dorking generally may be stated to constitute it a flesh-producing rather than an egg-manufacturing fowl. As it is most difficult to get all the good qualities in one variety, the Dorking's weak laying point can be readily understood, consequently to use this breed to the very best purpose we must have recourse to crossing, for which it is with several other breeds well suited. Dorking cocks mated with Brahma hens produce birds much the colour of Dorkings in both sexes, very uniform, and of handsome appearance; they grow quickly, feather easily and early, make big table fowls for the local markets at, say, six months old, and are credited with being good layers all the year round. Dorkings cross well with numerous other varieties, but the breed itself being so few in number, breeders who can produce them in quantities should find a ready demand for pure stock for years to come, which will pay them much better than breeding for the market.

Houdans.

Whenever table poultry and eggs are spoken or written of as the properties of any one variety, Houdans are the breed selected. That they have such attributes in France has been proved over and over again. The modern Houdan however of the English show-pen has shown itself a very moderate layer, the table qualities have in no way suffered, while the competitive system has done much to increase the size. Houdans are the best known and most general of the French varieties in Australia, their striking resemblance in shape and superior quality and fineness of flesh have earned for them the appellation of French Dorkings; they have small bones, large square bodies set on short legs, the long breast bone showing great meat capabilities. They lay a large white egg, but in this country at least do not justify their character as to numbers. The demands of the show-pen system for excessive crests, &c., has had an effect for ill which has been noted by all the practical poultry breeders of the old country, one eminent authority writing,—"The Houdan when introduced from France was a moderately close feathered, useful fowl for the table and market, and in striking contrast to the now full-crested, loose-feathered English show birds that are almost unable to see; as a farm-yard fowl the modern Houdan with its huge crest is useless." Without wishing to go as far as this authority, we cannot get over the fact that with all this varieties vaunted properties it has so far been a failure in Australia. The two leading poultry societies in this Colony and Victoria have been offering prizes for the past twenty years, to encourage the breed, but without success, the numbers being on the decrease. Houdans, to use the male, are most excellent for crossing purposes, and if a healthy, vigorous bird be used, ten to twelve hens can safely be put with him, with the guarantee of almost every egg being fertile; if mated to Minorca hens the result will be excellent. Pullets will generally be black with small top-knots. They commence to lay early, the eggs being large and white and produced in great numbers. With Leghorns they also do well, and where an egg supply is the object I know of few better crosses; with numerous other varieties Houdans also do well.

(To be continued.)

The Keeping of Grapes.*

P. MOUILLEFERT.

It is very important for vine-growers who cultivate their crops for sale in the fruit state, to know how to preserve the grapes, so as to be able to supply them at a time when they are scarce and dear.

At Thomery, for example, whilst grapes of the first quality are worth from 2 to 4 francs the kilogramme in September, they reach 8 to 9 francs in February and March, and even 10 to 12 francs per kilogramme (= about 2⅕ lb.) in April.

Some vine-growers, like M. Salomon, of Thomery, preserve as many as 100,000 bunches either on green or dry stems.

Grapes may be kept in several ways, of which the following are the principal ones.

(a) On the Vine.

When grown in the open air the preservation of the grapes depends chiefly on the state of the weather after ripening. If it is dry, they will keep two months or more; that is to say, in the Parisian climate. Grapes ripe at the beginning of †September can easily be kept to the end of October without any serious deterioration, but persistent rains will shorten the period considerably by favouring the development of fungus, which rots the berries and bursts them, as was seen in 1896.

Certain vines undoubtedly resist better than others, but the difference is not great. Among the best are Chasselas doré, Chasselas Violet, Dodrelati, Malvoisie Rose du Po, and Frankenthal. If the vine grows on a wall it considerably assists in their preservation to have the grapes sheltered by means of movable glass frames fixed in front of the wall, but allowing a current of air when it does not rain. The aspect also has an influence on the keeping of the grapes. Thus to the north-west or south-west, aspects which under the Parisian climate receive the rain, they keep much worse than with an east or south-east aspect.

In rainy years, the putting of the bunches in bags, in order to preserve them from wasps, will tend to rot them, by retaining the humidity longer round the grapes.

Grown under glass, the preservation of the grapes on the vine is much easier. First apply the process of retarding the growth, which we explained in a former article. These grapes having arrived at maturity, the soil must be kept dry with a temperature as nearly as possible 2 to 4 degrees above zero. The sun must be kept off by straw mats or blinds over the windows. Ventilate when the weather is clear and dry, and every day the bunches should be examined and the bad berries removed.

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* From *Le Progrès Agricole et Viticole.*

† The months mentioned are the French months—January there corresponding climatically with, say, July here.

Bear in mind that the vines most suitable for this method are:—Muscat of Alexandria, Bicane or Chasselas Napoleon, Royal Vineyard, and Chasselas de Fontainebleau. Blacks are:—Black Alicante, Lady Downe's Seedling, and West St. Peters. The blacks keep better than the white ones.

By careful manipulation, the grapes may be preserved in this manner on the stock until March and even April, that is, until the time when forced ones arrive in their turn at maturity.

(b) Preservation on Green or Fresh Stems.

To make use of this process, it should be done on a large scale, and in special rooms called fruit or preserving chambers.

These places should be as healthy as possible; that is to say, with a cement pavement over a cellar, on absorbent ground. Otherwise it is preferable to have them on the first floor. The walls should be from 24 to 30 inches thick, in order to prevent the interior being affected by sudden changes of weather outside.

The number of doors and windows should be restricted to those necessary for ventilation and the work. The windows towards the north should be of double glass, or covered with thick straw mattresses, or bags of oakum or sea-weed.

The distance between floor and ceiling should be 7 to 8 feet. Finally, in consequence of rigorous winters which might damage or ruin the process, it is prudent to contrive one or two openings which will admit hot air from a neighbouring chimney, in order to raise the temperature when required. This is preferable to having an open fire-place in the room itself, which would cause a heat detrimental to the preservation of the fruit. The interior of the room is divided into compartments a yard wide by horizontal and vertical battens forming racks, which receive the phials containing the bunches (*see* fig. 1). These phials (which hold 125 cubic centimetres and cost 4 to 5 francs per 100) are fixed in notches on a board (fig. 2), or in special rings (fig. 3), and the space between each must be small enough to economise space, yet sufficient to prevent the bunches from touching.

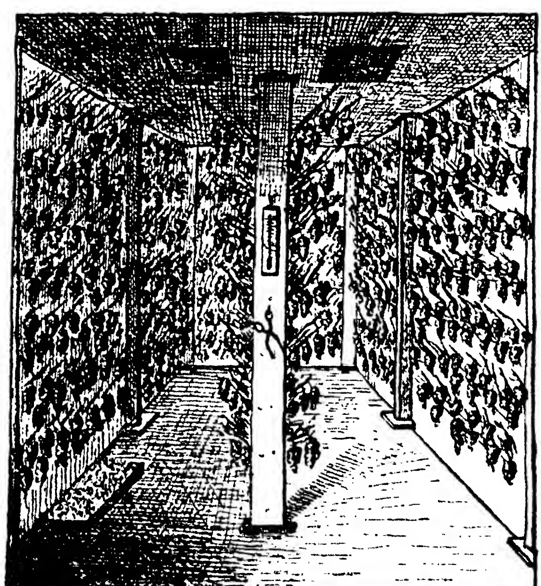

Fig. 1.—Preservation on the fresh stem.

The capacity of the phials is generally large enough to avoid the necessity of refilling with water during the whole time of preservation.

A 5-foot wide passage is left at each end of the room, in order to facilitate the diverse manipulation of the grapes, and also to promote ventilation.

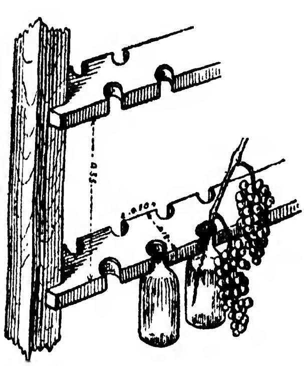

Fig. 2.—Phials supported in notched shelves.

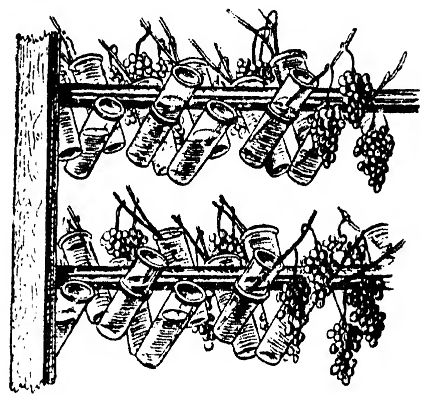

Fig. 3.—Phials supported in rings.

This arrangement is the one adopted by the viticulturists of Thomery, who have had the greatest experience in the art, as in that district over 300,000 kilogrammes are thus preserved.

Selection and Crop.

Grapes intended for preservation should be, it must be understood, well ripened, and from seven to eight year old stocks, which have not been overloaded with fruit. Those grown on chalky soil or chalk and clay are better for keeping than those grown on silicious soil.

The bunches should have been freely thinned, so that the berries are not too close.

The leaves should have been stripped off by degrees, after maturity only, and in such a manner as to diffuse the suns rays, and prevent them striking on the bunches.

The gathering should be done late, at the end of October, or even after, if the season is still fine; but under any circumstances it must be done in dry weather.

It is preferable to take the bunches from the top of the trellis, as being naturally better for keeping purposes. They are cut with a piece of stem long enough to introduce into the phial, having generally three eyes under the bunch and two above it, leaving upon the vine a stub long enough to provide the next cutting, unless there is another branch underneath which will supply it. It is necessary to proceed with caution, in order not to touch the berries and destroy their bloom. Proceeding with the cutting, place the bunches, of which there should be one or two on each piece of stem or branch, in special flat baskets which we have already described. The phials having been filled to the neck with water, and having each received a

teaspoonful of charcoal or a good pinch of bay-salt to absorb the gas which forms and to prevent putrefaction, the bunches are placed as shown in figures 2 and 3.

It is well to place a little grafting-wax at the upper end of the stem. They should be placed in the phials as early as possible on the day they are cut. This done, the fruit-room is closed, and the temperature must be maintained as regular as possible between 4 and 10 degrees above zero, with a hygrometric moisture not exceeding 70 to 72 degrees. Every day go through the compartment with a light, to ascertain the state of the grapes, and take away the damaged berries by means of long, sharp scissors. The development of mould should be prevented by lighting a sulphur thread, which in burning produces sulphuric acid, and kills these lower fungi. The fruit-room should be kept very clean, and not allowed to contain any substance susceptible to fermentation.

To prevent humidity, which is fatal to the preservation, have in the grape-room either small dishes of chloride of calcium, or boxes of quick-lime, which substances have great attraction for water, and replace them when saturated.

Refrigerating Apparatus.

In the district of the Nord, it is very easy to maintain the temperature of the fruit-room at 3 to 4 degrees, from the 15th November to the end of February; in fact, during very severe winters, on very cold days, it is necessary to warm the chamber to prevent frost, but this is not so in warmer climates. In this latter case it may be necessary to use refrigerating apparatus. This has been contrived and employed by M. Salomon, of Thomery, and seems to answer the purpose. It comprises a set of ice-making machinery. The substance adopted to lower the temperature of the refrigerating water is chloride of methylene, extracted from molasses.

The cold water comes from a reservoir or accumulator, and circulates in the tubes of the cooler, or thermosiphon, which pass through the fruit-room, and it may thus be lowered to 20 degrees of cold. But in order to prevent freezing, and to keep it liquid, add chloride of calcium to a density of 0·22, which permits a lowering of temperature to 22 degrees below zero without freezing.

With this apparatus, grapes may be preserved with much less loss, and very much longer—up to June and July if desirable. Unfortunately, this system requires a good deal of capital, and the cost of maintaining it is so great that it is only rarely used, at any rate in the Nord.

Among the varieties of grapes which have been found most suitable for preserving on the green stem, come in order of merit: Chasselas Doré, Chasselas rose royales, Lady Downe's Seedling, Muscat of Alexandria, Black Alicaut, Dodrelabi, and Boudates.

(c) Keeping of Grapes on the dry stem.

This is the simplest process of all, and also the one most used. The bunches are cut close to the stem and placed on trays covered with bracken or selected straw, of which the soft parts have been removed, as being more susceptible to absorb humidity and cause decay. These trays are placed on placed on special racks in the fruit-room, as was mentioned before.

This treatment is specially suitable when the fruit has not to be kept very long.

In large establishments in Thomery where this system is practised on a large scale it is arranged as follows :—

A kind of rack, furnished with drawers placed alongside each other (fig. 4), which can be closed or opened at will, is used.

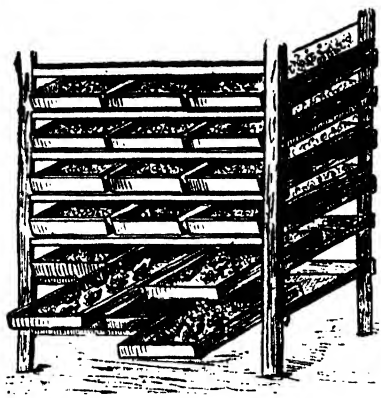

Fig. 4.—Preservation on the dry stalk. Movable drawers.

These drawers are about 24 inches wide, 32 to 36 long, and 5 inches deep. The bottom is covered with coarse rye straw, as before stated.

The bunches are cut in the same way as for the fresh process, and after being well cleared of damaged berries, are placed in the drawers with all possible care, beside, but not touching, each other, in order that decay may not be communicated from one to the other.

The rest of the proceeding is the same as before: Keep the room well closed, sheltered from light and air, at a low temperature as regular as possible. Avoid humidity, and frequently examine the drawers, to take away all decaying berries. By following these instructions faithfully, grapes may be easily kept until January or even February. No doubt they have not so fine a look as in the fresh stem process, but the latter costs much more.

(*d*) M. Petit's Alcohol Process.

According to the experiments at the National Horticultural College at Versailles by M. Petit, Director of the Laboratory at this school, alcoholic vapours have a very strong effect on the mould which habitually develops on the surface of fruit in a humid atmosphere.

The Chasselas grapes, placed on the 31st October, 1894, with a 100 cubic cent. of alcohol at 96 degrees in a small compartment of 180 cubic decimetres, made of brick covered with cement, with a close-fitting wooden door, situated in a verp damp cellar (95 degrees Hygrometric), and at a temperature of 8 to 10 degrees, were still, on the 20th November, looking quite fresh ; while, on the contrary, those without any alcohol were nearly all decayed and covered with mould—in short, they were destroyed.

After two months in the alcohol chamber, each bunch had not lost more than two berries. The quantity of alcohol required is relatively small—$\frac{1}{1800}$ to $\frac{1}{2000}$ part of the volume of the compartment. If the quantity is too small, mould will appear ; if it is too large, the grapes take a red tint, and acquire an objectionable alcoholic flavour. It is best to fix the quantity in each case according to existing conditions.

(*e*) Different processes of preservation.

M. Cousin, nurseryman at Villiers, has given the following process in the *Journal for diffusing the knowledge of Horticulture*, 1883:—

"Cut the bunches with a short stem at the end of October; taper the stem to a point, and fix it into a potato. These bunches are afterwards placed on very dry straw, where they keep just as well as if they were placed in phials, according to M. Cousin. Bunches of grapes stripped of leaves and suspended in a store-room or loft keep a long time.

"Separate bunches may also be preserved by hanging them by a piece of branch attached to them to a ring fixed in the ceiling, securing them by the end of the branch, as that allows the berries to be separated more easily.

"Finally, grapes may be preserved, but only for a short time, by securing the bunches to nails in the ceiling in a cool and well ventilated room; or even by simply depositing them on tables carefully covered with rye-straw."

Rules to be observed in applying the Tuberculin Test.

The following are the rules recently issued by the Board of Health of New South Wales with respect to the test for tuberculosis in cattle:—

Board of Health, New South Wales.

RULES TO BE OBSERVED IN APPLYING THE TUBERCULIN TEST.

Note.—Although this form is designed primarily for use by the Veterinary Inspectors of the Board of Health, it is desired that it may be employed by all who apply the tuberculin test to animals. The following directions, which it is very important to follow carefully, are therefore printed here. Forms will be supplied gratis on application to the Secretary, on condition that a copy of the record made is subsequently forwarded to the Health Department.

1. Animals should be confined during testing, and the natural temperature should not be taken until they have become cool and quiet after being first confined.

2. Animals under test should be allowed to drink only immediately after taking their temperature, and not within one hour at least before taking it.

3. The temperature must be taken in the rectum; a string should be attached to the thermometer and held; the thermometer, being about 6 inches long, should be introduced until its extremity is only just visible; it should remain in for five minutes by the watch; it should be withdrawn horizontally, and read while still in that position; the reading should be written down at the same time; lastly, the thermometer should be cleaned, and the mercury shaken down until it stands below 98°, before replacing it in its case.

4. The natural temperature of the animal to be tested must be taken during the daytime before the injection is made at night. It should be taken three times, at 9 a.m., at 12, and at 5 p.m.

5. It is convenient to inject the tuberculin late in the evening, or between 9 and 10 o'clock, so that observation of the reaction temperature may be begun early next day.

6. No attempt need be made to ascertain the reaction temperature before the ninth hour after injection, and no such observation, if made, is to be recorded on this form.

7. The highest natural temperature observed before injection is to be taken as the *datum* for comparison with the reaction temperature.

8. No reaction temperature is to be regarded as decisive of tuberculosis which does not exceed the *datum* temperature by two and a half degrees Fahrenheit, at least.

9. Animals suffering from advanced tuberculosis are liable not to give a marked temperature reaction, or, if they are already feverish, the reaction may not be noticeable; consequently, when the disease can be diagnosed with reasonable certainty by ordinary inspection, the tuberculin test should not be applied.

10. Animals, suffering very slightly from tuberculosis, sometimes give a marked reaction temperature. In cases in which a marked reaction temperature has been observed, and no diseased place is detected when the animal is first examined after slaughter, further and more careful search must be made. If a spot of disease is at last found which yet cannot be identified as tuberculosis by its appearance, it should be cut out, placed in spirit, and transmitted to the Board's Laboratory for microscopical examination, together with the details required in the form.

11. Every Veterinary Inspector of the Board who tests animals for tuberculosis will do his best to explain his proceedings to, and to instruct, both the owner and his neighbours.

[See next page.]

BOARD OF HEALTH, NEW SOUTH WALES.

Year.............. .....

TUBERCULIN-TEST RECORD.

District....................................... Owner's Name... Address.....................................

Description of Animal.						Observer's Name.	Thermometer Number. (4)	Natural Temperatures.				Injection.		Tuberculin.		Reaction Temperature at hours after Injection. (5)						Difference between highest *natural* temperature, and highest *re-action* temperature.	Signs of Tuberculosis during life. (6)	Organs found Tuberculous after death. (6)	Any other Disease detected after death.	Remarks. (7)
Kind.	Description. (1)	Brands.	Class. (2)	Sex.	Age. (3)			Date.	9 a.m.	12 noon.	5 p.m.	Date.	Hour.	Brand.	Quantity used.	9th.	12th.	15th.	18th.	21st.	24th.					

(1) Colour, &c. (2) Dairy, store, working, &c. (3) Distinguished young animals (the age up to which bovines are to be reckoned as *Calves* in one year—when younger, age to be stated in months). (4) With reference to correction—certificate. (5) Not to be taken before 9th hour. (6) In milch or breeding cows note state of udder especially. (7) Always mention total in herd, total inspected, and total found tuberculous.

Trees for Shelter and Breakwinds.

H. V. JACKSON,
Overseer, State Forest Nursery.

A MATTER of great importance to fruit-growers and farmers is the provision of sufficient shade and shelter from the too direct rays of the sun, and from the hot or cold winds that injuriously affect trees and crops.

It seems superfluous to quote the authorities who have laid it down that forests promote a greater rainfall, &c., some writers being very dogmatic in their statements, but we may be on the safe side if we admit that forests temper the winds, and that as the air in the dense forest growth is not renewed as freely as in open country, and the absorption or throwing off of heat is likewise less rapid, the tendency of the forest screen is to equalise or modify and regulate surrounding climatic conditions. The clearing of the lands for orchard purposes in fruit-growing districts, and the removal of all shade trees in wheat-growing country, has been in many cases done in such a way that it is evident no thought was given to the necessity for shelter or to their value as a means of providing food for bees, not even the indigenous trees of the locality being left along the road sides. There is no doubt, however, that lines of trees bordering roads and lanes would make some appreciable difference to the appearance of the face of the country and as breakwinds, but such lines of trees will never be the protection that belts of timber trees would have been had provision been made for them, for the shelter derived from a leafy screen depends of course upon the formation of the locality, the height of the tree, and the thickness of the belt in proportion to the height. Upon the character of the orchard will depend the variety of tree you will use for sheltering purposes, *i.e.*, if a screen is desired for the fruit in summer and yet some exposure is desired in winter (as in the case of (say) cherries), then a deciduous tree will be required, while if shelter is desirable winter and summer it must be of an evergreen species.

As for the varieties one may use, the characteristics essential in both cases may be stated as follows:—

(1.) The trees should be of commercial value.
(2.) They should not be surface-rooters.
(3.) They should be varieties least likely to harbour scale, beetles, or borers.

There is a tendency among those anxious to plant avenues, roads, or garden-plots, to run on *Pinus insignis*, *Schinus molle*, and *Ficus macrophylla*, and I have had inquiries for poplars for shelter for deciduous orchards. Now all of these are trees taking a great deal out of the ground, and surface-feeders, which throw out rootlets for long distances.

It may not be easy to get the exact varieties we want for our extensive range of climate, but we have one indigenous evergreen at any rate, which in a great

measure will meet our requirements, and I think stand first, namely, the Kurrajong (*Sterculia diversifolia*). It is of great value as a fodder and fibre plant, is very handsome as a shade tree, and is a deep tap-rooter and a clean tree.

Another evergreen, but an exotic, is the camphor laurel (*Laurus camphora*), which is a species, so far as I have seen, free from objectionable scale or insects. Though no attempt is made to manufacture camphor from it in this country, it is the camphor tree of commerce. Where these species cannot be grown, then probably some of our handsomest eucalyptus species will be best for the purpose, such as *E. saligna* (blue gum); *E. microcorys* (tallow-wood); *paniculata* (grey ironbark); *E. corynocalyx* (sugar gum).

In deciduous varieties—in localities where they are likely to grow—the American hickory, or pecan nut (*Carya olivaformis*) should be tried. It is a handsome tree, and valuable alike for timber and fruit, and is a deep tap-rooter. Then in districts not too dry, and where there is a moist bottom, *Taxodium distichum* (the Virginian swamp cypress or redwood) might be tried; it is very handsome and timber of value. *Platanus occidentalis* (the plane tree) also makes a handsome shade tree. There are many other deciduous trees, of course, that will answer the purpose, but the choice will depend somewhat upon the distance the trees may be planted from the cultivated plots. I may, however, say that poplars and elms and willows are objectionable, owing to the great distance their roots travel.

As for temporary and rapidly-growing screens of less height than trees will eventually become, where they can be grown, bamboos, the giant reed, *Arundo donax*, and pampas grass, *Gynerium argentium*, should be effective.

This matter of making provision for shade and shelter is one which old established settlers should take in hand in order to redeem any errors of the past. And the farmer, opening up a new piece of country, should look around him and take into consideration the natural features of his selection in regard to its situation and exposure before he sets to work to cut, grub, and burn off the natural growth of trees and shrubs, which, if left growing at various convenient points and along lanes and water-courses, would prove of so much value to him in the future.

Bee Calendar.

ALBERT GALE.

October.

Nearly the whole of last month drones were on the wing, and, as anticipated, queen-cells were in construction. Indeed, in the metropolitan district, during the latter part of August, my own were hatched, and on the 16th of last month my first spring swarm came out. From the stock they issued, neither in 1895 or 1896 did I get an increase. It was one of those ne'er do wells. Twice I had changed the queens, but nothing good followed. Early in last December I placed in it a strong swarm that half an hour before had issued from a neighbouring colony. There was no fighting; I had killed the queen of the weak colony. With new blood it became one of my best, resulting in giving me my first swarm this season. In the beginning of last month I noticed several small patches of drone blood. As there are numbers of drones on the wing, and swarming has begun here, it should be abundant further north. Speaking of drones, if what I have so often advocated, *i.e.*, old queens that were known by their fruits to have been very prolific and their progeny good workers, have been kept over from last season as drone breeders, the mating of young queens with high class drones will be sure to give the best results.

During last month the summer fruit-trees were aglow with bloom, and pollen stores were plentiful. Before this number of the *Gazette* is in circulation, swarming will be in full swing. If it is the "early bird that gets the first worm," undoubtedly it is the early swarm that gives most profit. The bee-keepers in the old country used to say, "A swarm of bees in May is worth a load of hay; one in June is not much out of tune; but one in July is never worth a single fly." The same rule holds goods here, in the corresponding months.

Be careful to see that room in the brood chamber is provided for giving the queens sufficient unoccupied space for laying purposes, otherwise she will use the empty cells in the supers.

There will not be much trouble in catching the *first* swarms of the season. It is the fertile queen that leaves with them; she cannot fly far; she is heavy with eggs, and will not proceed a hundred yards if she can help it from home. As soon as it is noticed that the swarm is issuing from the hive, watch the entrance, and pick up the queen as soon as she is outside. If you fail to find her, look for her in the flying swarm; a pregnant queen never flies very high. If caught place her in a queen cage, and hang her up in a convenient place. As soon as the swarm commences to cluster around her shake a handful or two into a box and liberate her amongst them; it saves a lot of trouble.

If it is intended to requeen, do not be later than this month. Procure laying and tested queens; it saves a lot of time. Be sure to get them from a healthy apiary. It is a safe rule, whatever goes wrong with your bees, to say it is the queen's fault. Of course there are exceptions.

The principal work in apiaries now is attending to swarming, requeening where necessary, and queen-raising.

Orchard Notes for October.

GEO. WATERS,
Orchard Manager, Hawkesbury Agricultural College.

THE notes given for last month that apply mostly to the warmer districts of the colony, especially those relating to the destruction of insect and fungus pests, will apply to the early parts of this month in the later districts of the Colony. The scab in apple, pears, and apricots is increasing in quantity and the number of districts infected, and should be very carefully watched, and, especially in our badly affected districts, there should be a unanimous vigorous onslaught on the codling moth in apples and, in many districts, pears also.

As repeatedly mentioned, for the scab in any of the fruits above-mentioned the Bordeaux mixture is the best; but if it has not been applied before the buds burst, it must be reduced in strength, using it no stronger than 6 lb. bluestone, 4 lime, and 40 gallons water. In districts where both the scab and the moth are prevalent it is advisable to use the Paris green for the moth with the Bordeaux, using 1 lb. Paris green to 160 or even 200 gallons mixture.

At any time Paris green is an awkward spray to apply unless kept thoroughly emulsified during the spraying operation; and I have found in practice that there is nothing better to mix it with for effectual application than the Bordeaux mixture. Of course it will be understood that if the Bordeaux is not necessary there is no occasion to add the bluestone; simply a little lime-water or soapy water will make a good addition.

An instance also in which the Paris green and Bordeaux can be applied together is for the black spot on grapes (*Anthracnose*) and caterpillars.

At the College vineyard last year, excellent results were obtained by the frequent application of the summer solution of Bordeaux for the spot on vines. Fortunately we were almost free from caterpillars. The red spider must be watched carefully during the month, especially on plums. Great quantities of fruit are spoilt by the premature falling of the leaves on these, owing to its attacks. About the end of the month the young insects will be hatched out. Destroy them by either spraying with the resin and washing-soda wash, or sulphur the trees by means of a knapsack distributor, the "Vermorel" being about the best.

As mentioned in last month's notes, as soon as the orange crop has been gathered and the fruit is set, where the black spot, "Maori," or rust mite is prevalent, get to work at once upon them, using the Bordeaux for the former and the soft soap and sulphur spray, or sulphuring in early morning, for the latter. I was astounded a couple of weeks ago at seeing a very considerable number of the oranges from several orange-growing districts affected, some very badly, by both of the above diseases. It behoves all growers to be on the alert and unitedly act in their destruction; for what is more unsightly than fruit to be covered by these dirty brown spots or scale pests either, and certainly they must depreciate their marketable value.

Another pest that is increasing in our apples is the mussel scale (*Mytilaspis citricola* and *Pomorum*). Several pieces of wood received from different parts of the New England district were very badly affected by these scales, and give one the impression that they are not feared sufficiently. For these the lime, sulphur, and salt winter spray is no doubt the best; but if the trees have not been so treated during the winter, during the spring, when the young scales are hatching out, they are then tender, and can be killed by the resin-soda wash. The spraying should be repeated two or three times at intervals, as all the young scales do not hatch at the same time. Generally speaking, the peach aphis has been rather prevalent owing to the mild winter. Those that were not killed before the fruit had set should be destroyed now as soon as possible, for, if allowed to remain, they distort the young wood into all shapes and spoil the appearance of the tree. Young trees should be attended to during the month. All laterals should be carefully pinched back, so that all the energy of the tree will go into the formation of the main branches, and thus save a lot of cutting at next winter pruning.

All grafts should be attended to, removing all but the strongest shoot. Stocks that have been budded should also be looked to. No suckers or shoots should be allowed to grow below the bud. It is very essential that stocks should be cut back properly. The cut should be slanting, being slightly lower on the side opposite to the bud, and it is advisable to stake them, not only to prevent their being blown out, but to encourage a straight barrel. Where grafts have been put on old trees they are even more liable to be blown off than small ones, and must be tied to prevent it. To do this a good stake should be lashed on to the branch grafted, and allowed to project a foot or more over to the end; then, as the graft grows, it can be tied to it. The orchard should be kept well cultivated and free from weeds. Too much cultivating can hardly be given during the next few months, especially in the drier portions. An excellent two-horse cultivator is the "Top Notch," and for a single-horse one the "Planet Jr." is an excellent tool. When cultivation is mentioned now, it means stirring and not turning the soil to prevent the formation of a crust. If we are fortunate in getting a good rain in October, by careful cultivation a good apricot and early peach crop is assured. Where obtainable, a good mulching of bush rakings or good stable manure is of great assistance in conserving moisture, and is of great value to any young trees, and especially those of the citrus family.

Practical Vegetable and Flower Growing.

W. S. CAMPBELL.

Directions for the Month of October.

Vegetables.

The weather is very often hot and dry about October, with strong warm westerly winds. It is of importance that the surface soil between the vegetables should be frequently worked, or a heavy mulch applied to prevent evaporation of the soil moisture. Large leafy vegetables like cabbages need good supplies of moisture during their growth, for their leaves evaporate immense quantities of water. Celery is another vegetable that needs a great deal of moisture; indeed it is hardly possible to grow really good tender leaf stalks without an abundant supply of water. Leeks and lettuces, and all vegetables grown for their leaves, need plentiful supplies of water, although it may be possible to overwater and cause these vegetables to become too watery.

Beans, French or Kidney.—These are, perhaps, the most useful vegetables for summer, and any of the numerous varieties, dwarf or runners, may be sown in quantity in almost any part of the Colony. The dwarf kinds are generally considered the best to grow, simply because they are the most convenient to manage, not requiring any kind of support. If the soil needs manure, apply farmyard dung. It is undoubtedly the most satisfactory manure for all sorts of vegetables; for although the percentages of nitrogen, potash, and phosphates may be but small in comparison with the bulk, the physical effects of this manure in the soil are most important. If it be thought desirable to add some chemical manure to the farmyard dung for beans, then add chiefly potash and some little superphosphate; but there is no need to add anything that may have a preponderance of ammonia, such as sulphate of ammonia. Lime will be found useful for beans—either the common lime, carbonate of calcium, or gypsum sulphate of lime; but if superphosphate of lime be applied there will be no more need to use gypsum. After preparing the land well, sow the beans in rows about 2 feet 6 inches to 3 feet apart. Make the drills about 4 inches deep and drop the beans in the drills about 4 to 8 inches apart and cover with soil. If the weather be favourable the plants will begin to bear in about six weeks from time of sowing. Try several kinds, both dwarf and runners, for there is a considerable difference in quality. Sow the runners wider apart than the dwarfs, and provide some stakes or other supports for them to run up.

Beans, Lima.—This vegetable is quite different from the kidney bean, for the seeds and not the whole pods are eaten; but the habit of growth is somewhat the same, and there is a dwarf as well as a running variety. Treat the same as the French or kidney bean.

Beet, Red.—Sow a little seed in drills about 18 inches apart. The seed sometimes takes a long time to start with growth, especially if the soil be dry. In order to hasten germination, the practice is sometimes resorted to of spreading out the seed on a damp bag and covering it with another damp bag. In the course of a few days signs of growth will be seen, when the seed may be sown; but if the soil be very dry it would be well to water after sowing. When the plants are large enough to stand by themselves, thin out to about 9 inches apart. The soil should be well and deeply dug, but fresh manure should not be applied or else the roots are liable to become unshapely and branched or forked.

Beet, Silver.—Sow a little seed on rich well manured land. This vegetable is not grown for its root but for the leaves and leaf stalks, which are used as spinach. It is desirable, therefore, to grow these leaves tender and succulent. Liquid manure will be found of much advantage in promoting favourable growth.

Cabbage.—Sow a little seed in drills in a seed-bed. Shade this with some light shading and apply water regularly, preferably in the evening or early morning. A few well-grown, strong, young cabbages should be planted in rich, well-dug-up ground. Plant with care and avoid breaking the roots.

Cauliflower.—Sow a little seed, and plant out a few strong plants if any are ready.

Carrot.—Sow a few rows in drills, about 1 foot to 18 inches apart. As the seeds are liable to stick together, in consequence of their being covered with little hooks, they should be rubbed well before sowing. Carrot seed takes a long time to come up, and as the plants are tender whilst young the bed should be kept well weeded, so that weeds do not interfere with the young plants. It is inadvisable to apply fresh manure for carrots. The ground that had been used for some previous heavily-manured crop, such as cabbage, would be most suitable for carrots.

Celery.—Dig some ground well and deep and apply heavily good farm-yard manure. Plant in shallow trenches, about 1 foot apart, in single rows, for this is preferable to several rows together. The stalks may be blanched by earthing up when nearly full grown or by boards, drain-pipes, or anything else convenient that will keep away the light. If earthed up, care must be taken that the soil does not fall in between the leaf stalks. Apply abundance of water and liquid manure whilst the plants are growing. Sow a little seed for a fresh supply of plants.

Cucumber.—Sow a few seeds to keep up a succession.

Cress and Mustard.—Sow a patch from time to time, in order to keep up a supply of these very useful salad plants. The soil should be rich or made rich with well-rotted manure. These plants are usually sown together, and are about the easiest things to manage.

Capsicum or Chili, sometimes known as pepper or Cayenne pepper.—There are numerous varieties, large and small. Some of the smallest are intensely hot and the largest are generally the mildest. A very few plants will be found sufficient. Sow seed in a seed-pan or box, and afterwards plant out about 3 feet apart. Some kinds are very ornamental when covered with the ripe pods, and are used in gardens solely for that purpose.

Egg Plant.—Sow seed, or plant out a few plants from the seed-bed. This is not a very favourite vegetable in this Colony. If no plants have been raised a little seed may be sown.

Kohl Rabi, or turnip-rooted cabbage.—Sow a little seed in a seed-bed, and when the seedlings are large enough plant out like cabbage. This is not a very favourite vegetable; therefore a very little seed had better be sown for a first trial.

Leek.—Sow a little seed in a seed-bed, and afterwards transplant to ground that has been well prepared and made very rich. Leeks need plenty of manure and moisture, and manure with nitrogen predominating. If any young leeks large enough for transplanting are available, move a few from time to time. Plant them deep in the soil. Any leeks that have attained nearly their full size may be earthed up like celery to blanch their stems.

Lettuce.—Sow a little seed. Plant out from seed-bed strong well-grown plants into heavily-manured ground. Do not let the plants suffer from want of water. During the summer lettuce are very apt to run to seed and become worthless for use. Feeding the plants well will be a considerable preventive of this. It is a practice sometimes to sow in drills, thin out the plants when large enough, and let those remaining mature where the seed has been sown.

Melon, Rock or Water.—Sow seed in well-manured land unless it be naturally in good heart. Plants from early-sown seed should be making good progress by this time in warm districts.

Okra.—Plant out from seed-bed strong young plants from 2 to 3 feet apart. Sow a little seed for later planting.

Onion.—Sow a little seed, keep the soil well worked between growing onions and scatter amongst them a mixture of half soot and half salt, which will tend to improve them. Do not earth up the onions, but on the contrary draw away the soil from the bulbs so as to expose them to the sun and atmosphere.

Parsnip.—Dig some ground about 2 feet deep, and sow a little seed in drills about 2 feet apart.

Peas.—Sow a little seed occasionally to keep up a succession, more particularly in the cool parts of the colony.

Potato.—Plant out a few clean medium-sized whole potatoes; reject any showing signs of scab or potato moth. The ground should be rich, and if naturally poor apply a heavy dressing of farm-yard manure. Potash, in the form of sulphate of potash or kainit, will greatly improve ordinary farm-yard manure for potatoes.

Pumpkin.—Sow a few seeds of the ironbark variety of pumpkin if it can be obtained. The crown pumpkin is also a good variety.

Radish.—Sow a few seeds from time to time to keep up a continuous supply. When preparing the ground apply well-rotted manure. Make the surface soil fine and sow the seed in drills.

Rosella.—Will only succeed well in the warmest parts of the Colony. The plant is a variety of hibiscus and the part made use of for preserves is the flower calyx. Sow seed in pots or boxes and transplant when the seedlings are large enough.

Rhubarb.—A little seed may be sown in the early part of the month.

Tomato.—Plant out largely from the seed-bed, or sow seed to any extent that may be necessary. The plants should be supported as they grow, so as to keep them off the ground as much as possible.

Turnip.—Sow a little seed in drills.

Vegetable marrow and squash.—Sow a few seed from time to time to keep up a sufficient supply.

Flowers.

During the month of October, many of our most beautiful flowering plants are at their best, particularly the roses; and of the several kinds, those known as the hybrid perpetuals are most resplendent. These are really not nearly so prolific or perpetual as most of the tea-scented hybrid teas and Bourbons; but the brilliant colours and beautiful forms of the hybrid perpetuals entitle them to places in all gardens.

Bulbs of many kinds will come into bloom during this month, such as lilum of varietes, gladiolus, and many others. The leaves of daffodils and other bulbs which have completed their flowering should be allowed to wither away and not be cut off, for the material collected by these leaves is stored away in the bulbs as the leaves die away and this material is very necessary for the next season's flowers and leaves.

Semi-tropical plants, cannas, palms, ferns, coleus, alternantheus, and tender annuals may be planted out, but they must be well looked after, and kept well watered and shaded if necessary.

Chrysanthemums of varieties may be planted out, or cuttings from those already growing may be propagated for a new and better supply.

Trim up hedges and edgings, and keep grass plots and edgings to walks well cut, and in neat order.

General Notes.

Wide Tires.

It is hard to think of a subject that is of more concern to the agriculturist than the road-haulage of produce. One of the most important considerations in connection with the matter is the question of draught and the factors that influence it. Perhaps the most important of these matters is the width of tire, and the relationship between the condition of the roads—especially unmacadamised country roads—and the tires that pass over them is worthy of investigation. In other countries great attention has been devoted by the agriculturists themselves to this subject, and in some places the width of tire is controlled by legislation. Whether such measures are desirable or not cannot, of course, be discussed here; but if any of our readers care to send in the results of their experience as to the relative advantages or otherwise of wide as against narrow tires on different classes of country roads, we would be glad to publish the information. In the meantime, we reproduce from a bulletin compiled for the Department of Agriculture, Washington, U.S.A., by Mr. Roy Stone, Special Agent in charge of the Road Inquiry, 1895, the particulars of some experiments with different kinds of tires on roads, sod, ploughed fields, &c., together with the opinions of a number of eminent authorities, and a summary of the regulations respecting the width of tires in different parts of Europe, and in Canada and the United States.

Experiments with Wide Tires.

Experiment in New York.

From the limestone quarry at Split Rock to the works of the reducing company in Geddes, Onondaga County, N.Y., is about 4½ miles. Three or four years ago the work of improving this 4½ miles of road was accomplished. Rough quarry refuse, and for part of the distance field stones, were used, all hand-broken to 2 and 3 inch sizes. This was covered with fine, unsifted quarry chips, and a crown was given to the roadway with an elevation of about 6 inches in a width of 16 feet. Waggons were built for hauling stone over this road with wide tires and axles of different length, as follows:—Front tire, ⅞ in. thick and 4 in. wide; distance between centres of front wheels, 4 ft. 5 in. The rear wheels had tires 1 in. thick and 6 in. wide, the distance between centre of rear wheels being 5 ft. 8 in. The axles were 2½ in. front and 3 in. rear. The constant use of these waggons during the last three years has produced a smooth, compact, and regular surface between the quarry and the works. The wide tires and varying gauges excited much attention at first, and conflicting opinions regarding their utility were expressed. The result is eminently in their favour, and a general sentiment supports the use of these waggons for heavy loads. Loads of stone, varying from 8,000 to 16,000 lb., are continuously hauled over this road with no

perceptible wear. The cost per ton of hauling stone has been reduced from 80 cents to 60 cents, and a team can easily earn from 3 dol. 50 cents to 4 dol. per day hauling wall stone, making two round trips of 9 miles each, or a total of 18 miles per day.

Experiment by the Studebaker Waggon Company.

On June 1 and 2, 1892, a series of experiments to determine the relative value of broad and narrow wheel tires under different conditions were made under the direction of Mr. J. M. Studebaker, of the Studebaker Waggon Company. In these tests the regulation farm waggons were used with tires of $1\frac{1}{2}$ in., 3 in., and 4 in. in width.

A Fairbanks dynamometer was attached to the doubletree, and the horses exerted their pull through this instrument in order to move the load. The scale of this instrument was carefully calibrated by comparison with the United Standard Weights and Scales, thereby enhancing the value of the result. Eight tests were completed.

The conclusions arrived at were summed up in this way:

1. On hard roads, block pavements, and other permanent and substantial roads there is no argument, so far as actual draft is concerned, in favour of the wide tire, the effect being rather against the wide tire.
2. In their effect upon hard roads the wide tires have the advantage, and this benefit is not sufficiently appreciated by turnpike and macadam road companies.
3. In soft mud, slush, and under similar circumstances, under which even wide tire cuts in, the advantage is against the wide tire and in favour of the narrow.
4. On sod and soft ground, where the wide tire does not cut in and the narrow does, the advantage is on the side of the wide tire.

The committee closed their report with, "We advocate wide tire for farms and narrow tire for good roads and pavements."

Experiments in Utah.

Experiments at the Utah Experiment Station demonstrated that a given load on $1\frac{1}{2}$-inch tire drew about 40 per cent. heavier than when on a 3-inch tire, the draft being on a fairly stiff grass sod. On a moist, but hard road, the $1\frac{1}{2}$-inch tire drew 12·7 per cent. heavier than the 3-inch.

Experiment in Ohio.

The following wide-tire test was made at the Ohio State University:—An ordinary waggon with a new 3-inch tire was loaded with two long tons, or 4,480 lb., and the draft was measured by a dynamometer. On an ordinary earth road, in good condition and hard, the draft was 254 lb. On a grass field it was 468 lb. On newly ploughed land it was 771 lb. As the draft power of an ordinary horse of 1,000 lb. is 150 lb., two horses could draw this load with ease on an ordinary road, and $1\frac{1}{3}$ ton on a grass sod, while with a narrow tire half as much, or a single ton, is a full load for a double team. Besides this, the broad tires roll and level a road so that the more it is used the better it becomes, while narrow tires cut it into ruts, if at all soft.

Experiment in Missouri.

A few years ago a number of tests were made by Professor Sanborn, of the Missouri Agricultural College, to find the force required to move loaded

waggons having tires of different width. The tests were made with a Baldwin dynamometer. The weight of the load drawn was 3,665 lb. each. The tires of the wheels were 1½ in. and 3 in., respectively. The tests were made on blue grass sward, partially moist. The draft of the wide tires averaged for level ground 310 lb. The draft of narrow tires was 439 lb., or 41·6 per cent. more than the wide tire. Assuming the waggon to weigh 1,000 lb., then on the broad wheel 3,248 lb. of load would be drawn as easily as 2,000 lb. on the narrow tires. Again, the broad wheels in the trial did not injure the turf, while the narrow wheels cut through it. The teamsters about the college farm invariably use broad wheels.

[It might be added that a series of practical trials concluded recently at the Missouri Agricultural Experiment Station have confirmed the opinion that wide tires have the advantage of minimising draught and saving the road. In California it has also been decided to enforce the adoption of tires from 3 to 6 inches wide according to size of axle.—ED. *Agric. Gaz.*]

Vermont Report.

The Vermont Highway Commission makes the following report:—"If the present law was so amended as to limit the allowed weight per inch of tire to a definite number of pounds, we believe that this would best accomplish the desired result. To determine what this limit should be we have measured and weighed a large number of waggons representing a great variety of the heavier traffic in the State, and have concluded that the maximum weight, including waggon, allowed per inch of tire should be 550 lb. This is higher than placed by most authorities, but is far less than is the average on city pavements. The following table shows the load, including the weight of the waggon, that could be carried under such a regulation on varying sizes of tires:—

Width of tire in inches.	Allowed load (including weight of waggon.)	Width of tire in inches.	Allowed load (including weight of waggon.)
	lbs.		lbs.
2	4,400	3½	7,700
2¼	4,950	3¾	8,250
2½	5,500	4	8,800
2¾	6,050	4½	9,900
3	6,600	5	11,000
3¼	7,150	6	13,200

For vehicles provided with suitable springs the allowed load could properly be increased one-third.

It will be seen, therefore, that wide tires are not only lighter in their draft than narrow ones under nearly all conditions, but they cut up roads very little; in fact, when 6 in. wide they tend to make the road better continually.

Opinions of Correspondents.

G. A. Roullier, C.E., Flushing, N.Y., says: "I have followed with interest the operation of the wide-tire law since its first passage in this county, and cheerfully place at your disposal such facts as I have. The original law, calling for a 5-in. tire, had to be amended a number of times before it became acceptable to the people. Not so much on account of any

special opposition to the wide tire, but owing purely to practical difficulties. As the districts travelled over by our farmers on their way to and from market abound in street-railroad tracks, it is a necessity that the waggons should have the same gauge as the tracks; it was found that owing to the peculiar construction of our farm waggons, it was impossible to widen the tires to 5 in. and still maintain the gauge to 4 ft. $8\frac{1}{2}$ in., as the waggon bodies would not allow the wheels to be brought sufficiently close together; in other words, there was not space enough between the wheels and body to admit of such a wide tire. Hence the law was changed to 3 in. The reason given above is of course purely local, and is only mentioned to explain the somewhat narrow limit adopted. Those who have complied with the law are well pleased with the result, and are urgent about others following it. I gather from conversation with farmers who have to travel over earth roads before reaching the improved ones that they realise the benefit that the wide tire is to them, and that their new waggons are likely to be built so as to admit of 4 and 5 in. tires, so that in a comparatively short time I expect to see really wide tires in very nearly general use. When I purchased the road-repairing outfit for Flushing, I had 5-in. tires placed on the sprinkling carts and on team waggons, and 4-in. ones on the one-horse carts. These were the first wide tires seen in this vicinity, and I was subjected to considerable ridicule for a time, but the local contractors were not slow in appreciating the benefits resulting from such tires, and of their own volition they adopted 4-in. ones throughout. The benefits that will result to the roads is unquestioned, but the law having gone into effect only last fall, the time has been too short to allow of a practical demonstration of those benefits.

From experience here I believe that in localities where serious opposition is developed against the "wide-tire law," a gradual application of it will eventually produce the desired result. It is simply a question of convincing the community; once self-educated they will go beyond the limits set by the law. The Jamaica road is holding out well, and is carrying without injury to itself a very large and heavy traffic that has developed since its construction. As a matter of interest I will state that the construction of that road has thrown the heavy traffic above-mentioned on some 4-inch roads, built within the village limits at a time when the improvement of the Jamaica road was not thought of, and that these thin roads have borne the traffic without injury. I do not wish to be understood as advocating such thin roads for heavy traffic, but I wish to show that under favourable conditions much thinner construction can be used than is generally considered necessary."

Sterling Elliott, editor *Good Roads Magazine*, says: "Of course everyone is familiar with the Michigan wide-tire law. I have a number of reports from that State, showing that it is giving very good satisfaction except where they still retain, in some parts, the old method of 'working out' the tax. I think if we can encourage a tendency in the direction of wide tires, and get those who are quick to learn to adopt them, and thus prove that they are an advantage to the teamster as well as to the road that after a few years it will be very easy to get legislation which will entirely prohibit the use of narrow tires."

W. C. Nones, President of the Kentucky Waggon Manufacturing Company, says: "The demand for wide-tire waggons seems to be increasing each year. We cannot, without too much delay, undertake to state just the number of waggons with tire 3 inches or wider that we have manufactured in each of the past two years, but at a rough estimate, would say that about one-tenth of our entire output would come under the above-mentioned class, somewhere from 1,500 to 2,500 waggons each year. In our judgment these

wide-tire waggons are an improvement upon those with narrow tires in those sections of the country in which waggons are used on dirt roads, and they are also better adapted for miscellaneous hauling in general farm use."

Robert J. Neely, dealer in farm machinery, Paris, Ky., says: "I have sold quite a number of wide-tire waggons in the past three years. The sale of them is steadily on the increase. I believe that a few more years will see them used almost altogether. The turnpike companies in this country offer a reduced rate of toll to all persons, farmers, and teamsters who use wide tires. Aside from this, the farmers like the wide tires better than the narrow strictly for farm use, as the wide do not cut into the ground so readily as the narrow ones. There are probably forty or fifty waggons with $2\frac{1}{2}$ and 3 inch tires in use now in this county."

Newspaper Notes.

M. J. Lewis, a well-known wheelman, and an advocate of good roads, said: "I took a ride over the country roads on Thanksgiving Day and found them hard riding. In my wanderings I came upon waggon tracks made by 6-inch tired wheels. These tires made the country roads where they had travelled almost like a pavement, and I followed the tracks until I found the owner of the waggon, who, in conversation, said he could haul heavy loads with such tires when the roads were in a very bad condition."

On soft roads where these tires have gone over, it makes it an easy matter for cyclists to spin over the country. Mr. Lewis spoke to several farmers regarding these wide wheels, and they are soon to use them.—Youngstown, Ohio, *Indicator*, December 6, 1894.

A law was made by our legislature about fifteen years ago, requiring all lumber waggons to be used in our county to be of wide tire, and this was to be within twelve months' time, but the law fell dead on the statute book, as it was found impracticable to fix wide tires on the old waggons within the time required, if at all. But public opinion was educated through the Santa Clara Grange in favour of the wide tire, and it is now a rarity to see an old-time waggon on the road.—I. A. Wilcox, member of Santa Clara Grange, California.

By an experiment recently made in Ohio University, it was found that a double team could draw, upon an ordinary waggon with the 3-inch tires, just twice as heavy a load as upon a waggon with the usual narrow tires, the trial having taken place upon an ordinary earth road. It has been found also that the wide tire helps to keep earth roads in order.—Kelly, Ga., *News*.

Within the past year the Ulster County Road Improvement Association has been formed to remedy the evils resulting from years of bad management. So far, the Saugerties road, with the exception of 1 mile, has been put in good shape. Teamsters, who cart building stone, have found out this fact, and are hauling over this road. These teamsters usually draw from 4 to 6 tons on narrow-tired waggons, making deep ruts and ruining the road. Some time ago a plea for the enforcement of the wide-tire law was presented to the Board of Aldermen and referred to the Committee on Streets, where it died. It is useless to repair the roads and allow narrow-tired waggons to again ruin them.—Kingston, N.Y., *Leader*.

A country correspondent expresses the idea with good Yankee plainness when he says: "Farmers want common-sense laws founded on common-sense principles. They believe that the best means to preserve the roads in good condition is to have wider tires on waggons drawing heavy loads. All roads on which waggons with wide tires are used you will find smooth and free

from ruts; but roads on which narrow tires are used will be rough, with deep ruts, which make them very bad for light vehicles and sometimes impassable."

The agitation for good roads is having an effect. The *Pullman Tribune* is pleased to see the number of wide-tired waggons that have come into use this season, and it wisely adds: "Next to macadamizing the roads, which will be impossible for several years, wide tires will do the most good."—*Oregonian*, Portland.

Upon the topic of good roads, Mr. A. C. Sisson says: "I suggest as a starter that farmers adopt the 5-inch tire and shorten the forward axle. Wherever this is tried it is found that the tire helps the road, whereas the narrow tire cuts into and spoils the road. This they can do without changing the tire, by going to a blacksmith and having an extra tire put on over the other one."—*Baltimore American*.

"It is to be hoped that the first legislation looking to the improvement of the roads of the country will be in the way of encouraging the use of wide tires, for one narrow-tired waggon will do more damage than a dozen with wide tires if the roads are at all soft. No one disputes the philosophy of wide tires, and no one seems to have any good reason to offer why they should not be used. Our farmers simply follow precedent, and go on using narrow tires because their fathers did before them. Lumbermen and freighters use wide tires almost universally, and save money by it."—*Baltimore American*.

Width of Tires Prescribed in various Foreign Countries.

[Consular Reports.]

Austria.

All waggons built for a load of more than $2\frac{1}{4}$ tons must have wheels with rims at least $4\frac{1}{3}$ inches in width (Styria and Carinthia), and if built for more than $4\frac{1}{2}$ tons (in Styria) or more than $3\frac{1}{2}$ tons (in Carinthia), the rims of the wheels must be at least $6\frac{1}{4}$ inches broad. In lower Austria a width of wheel rim of $4\frac{1}{2}$ inches is required for loaded waggons drawn by two or three horses, and in Bohemia the same regulation is in force.

France.

Every freighting and market cart here is a roadmaker. Its tires are from 3 to 10 inches in width, usually from 4 to 6. With the few 4-wheeled freight vehicles used the tires are rarely less than 6 inches in width, and the rear axle is about 14 inches longer than the fore, so that the rear or hind wheels run in a line about an inch outside of the level rolled by the fore-wheel.

Germany.

The Act of April 16, 1840, prescribes that waggons for heavy loads, such as coal, brick, earth, and stone, must have a width of tire at least 4 inches. The same Act provides that all vehicles must have a flat and not rounded surface of the tire. All light vehicles must have a width of tire of at least $2\frac{1}{2}$ inches.

Switzerland.

Waggons must be provided with wheels having tires of a width proportional to the largest loads admissible. Two or more horse waggons shall have a width of tire not less than 1 inch for each draft animal. Vehicles for transportation of heavy objects which cannot be taken apart must have a tire not less than 6 inches wide.

Canada.

In Ontario the Department of Agriculture advises that with waggons without springs, the tire should never be less than 2½ inches in width for a load of from 500 to 1,000 pounds on each wheel. For loads of from 2,000 to 3,000 pounds to the wheel each tire should have a diameter on the face not less than 6 inches. This recommendation will be adopted in Ontario this winter (1895).

Practical Instruction in Ensilage.

Mr. H. J. Nesbit, of Kent Grove Dairy, Young, in a recent communication, suggested that if in the proper season an expert would visit districts to supervise the building of ensilage stacks on some farm to which farmers in the neighbourhood could be invited, good results would follow. Mr. Nesbit expressed his readiness to provide the requisite material.

The proposal has been brought under the notice of the Travelling Agricultural Instructor, Mr. J. L. Thompson, and he will arrange to carry out the idea during the present season.

As the applications for Mr. Thompson's services to lecture in various districts are numerous, it will be necessary for those desirous of organising a party to receive practical instruction by putting up the fodder under the expert's personal direction, to give ample notice and to make well beforehand all necessary preparations so as to have plenty of material in readiness and to secure the attendance of as large a number of the neighbouring farmers as possible.

Buckwheat.

In his annual report for 1896 the Farm Foreman (Mr. George Cobb) of the Hawkesbury Agricultural College, remarks: "Three acres of buckwheat were sown in the first week of October, viz., 2 acres Japanese, 1 acre Silver Hull. This crop did fairly well, having the advantage of a low, sandy spot. Buckwheat is a first-class plant to grow if for no other purpose than for bees. It can be sown at intervals from the end of August to the end of January, and is continually in bloom throughout the spring, summer, and autumn months. Again, this crop is especially easy of culture, and about 1 peck of seed per acre may be sown in drills 22 inches apart. During the period of growth the Planet Junior should be passed through the rows about three times, and it is surprising to see how the plants respond to such treatment.

Cutting and Curing Small Crops of Hay.

In my experience grass cut when in full blossom will give the best results in the production of beef, milk, butter, and cheese. This stage indicates the completion of the storage of plant food. After this there is a gradual change of the nutritious green and succulent substances of the plant to woody fibre. Grasses that are just coming into blossom are very satisfactory for hay, but there is danger of their containing too much of the laxative property.

In the production of large quantities of grass for hay, my belief is that as we cannot secure the whole at just exactly the right time it is best to err somewhat by commencing a little early, so that the greater portion may be secured by the time the full bloom is out, leaving choice pieces for horse hay to become a little more mature, and cut just as the grass is going out of blossom. A good healthy horse reasonably driven and worked will not suffer from laxness if fed on hay cut at this stage.

Hay never should be stored until all moisture, whether from rain or dew, be thoroughly dried from the outer surface of leaf and stem. This moisture is very different, so far as the keeping properties of the product is concerned, from the juices which sometimes give the hay an uncured appearance. Atmospheric moisture should be religiously guarded against in the field by the use of hay caps and proper piling. In fact, grass never should lie flat over night, and if unfortunately wet weather is indicated after the mowing machine has run a part of the forenoon, rake and pile the green product in safe small heaps. This will preserve the aroma coming from the waxy deposit upon every blade, stem, and blossom of all cultivated grasses, and also the green colour. Grass cut in the afternoon should at least be drawn into large wind-rows, and as much done in the way of raking scatterings and putting all in as compact form as possible to prevent exposure to dew. It is a mistake to salt hay because it is a little too damp to keep. Animals are thus obliged to eat salt when they do not crave or need it, and a derangement of the digestive system is quite liable to follow. Overdrying injures hay very much. If watched closely this can be prevented by piling immediately when too rapid curing is apparent.

In shocking tuck the hay under the heap nicely and neatly with the left foot. It can be done quickly, and the advantage cannot be appreciated until tried. Never shake out hay until the dew is off, but commence as soon after this as possible, for much hay can be nicely stored before noon when the weather is good. It pays to start the tedder or shake up by hand soon after mowing commences, and after the heaps are shaken out.

In the cutting and curing of clover good weather is especially desirable. A safe rule to follow is to cut when the heads are half turned. Dry as fast as possible, and if the weather is clear and dry pile in fair sized heaps, trim up well, tuck the hay under at the bottom, put on the hay caps, and let stand until the clover appears well cured, and will keep after airing a few hours. Open as soon as the dew is off when the weather is the best, but do not shake out much, and do not dry so that the leaves will crumble. It will keep by simply drying off the outside moisture.

If hay must remain out a number of days because of cloudy weather, it is an excellent idea to double the heaps, as a much smaller amount will be exposed to moisture. It requires considerable experience to know just when hay is in best condition to store. Take a wisp and twist it. If it feels like a wet rag it is not fit for storing. Do not pass judgment upon a large lot by simply trying one wisp. Go over the whole field and try some underneath as well as on top of the shock, and when it all has that general dry feeling, so well known from careful and well-studied observation, commence to haul immediately, and lose no time in putting it all under cover. Keep in mind that a thoroughly desirable product is always in demand, and it is the quality that is questioned and not the price by the buyer, who knows a good thing when he sees it.—A. A. Southwick, *American Agriculturist.*

Harvesting Oats on a Small Scale.

I like to cut oats before they are fairly ripe. If harvested when the kernels are just beginning to harden the straw will be almost as good to feed as hay, and the grain will be bright and rich.

I usually let my oats lie in the swath for a day or two, until well dried out. Then they are raked, bound and set up in shocks of ten bundles. There is room for a great deal of care in this part of the work. Grain carelessly put up

will in stormy weather become wet easily. My way is to set up eight bundles "two and two." Then I take two bundles, and, standing them on the butt end, split them by pulling the heads down toward the ground until half the bundle has been treated in that way. Then I turn the bundles over the top of the shock, one on one end, and one on the other, butts together. These form a cap which will, after fairly settled, greatly protect the shock from injury by storm. Some hold the bundle against their bodies while preparing them for caps, and others bind part of their bundles with the band nearest the butt, and use these for caps. No doubt they do make better caps. The Dutch cap is made by setting the bundles in a round shock, and opening one large bundle so that it will stand with the butt upward, covering the entire top of the shock. This is a good way to put up grain.

After the grain has stood for a week or two, depending upon the weather, it will do to go in. If the shocks seem damp, it may be necessary to set them apart for a few hours in the sunshine.

Of course, if one has a large crop, and uses a reaper and binder, it may be necessary to let the grain stand a little longer before cutting, but even then it may be done before the crop is dead ripe. It will not shell then, the grain will be much finer, and the straw a great deal nicer. Oat straw is coming to be valued much more highly than formerly. It used to be common to see great stacks of straw rotting, or burning down in the field or near the barn. We have learned that straw has a good market value, and that we may add many dollars to our receipts for the year by cutting oats early and properly caring for them.—E. L. Vincent, *American Agriculturist.*

Cow Peas for Seed.

Before harvesting let the pods of the peas get fairly dry, but do not allow them to stand until shattering will result. Of course all will not ripen evenly. Some pods will be dry before others are fully formed. Judgment must be used as to the exact time of cutting. Peas do not shatter very readily, so it is best to let them get pretty thoroughly ripened. Cut with a mower, rake up and pile in small cocks until the vines have dried. If the weather is not rainy or damp they may be put into small stacks, where they will dry out completely. But it is best to haul to some open shed or the barn, and spread out on the floor or racks until threshing-time. If there is any tendency to mould, turn over occasionally. With dry air there will be but little difficulty in getting them thoroughly dried.

If a bean thresher is owned in the neighbourhood run the peas through this, and they will come out cleaned and ready for storing. The straw will probably be so woody that stock will not eat it readily, but put it somewhere in the feed lot so that the animals may pick at it at will. If no regular bean thresher is available, an ordinary wheat thresher can be used by taking out about half the concave teeth and lowering the concave, then properly arranging the screens. If a barn floor is available, the peas can be tramped out with horses and cleaned with a fanning mill. This, of course, is a somewhat tedious process, but where only a few bushels are wanted for seed it answers very well.

Store the peas in a dry place, putting in sacks or bins. If there is any danger from the pea or bean weevil, put into a tight bin, or better, a tight box, and place an open vessel containing carbon bisulphide on the top. The bisulphide being heavier than the air will settle down through the peas, effectually destroying all insect life.

Cow Peas as Green Manure.

Mr. Geo. Cobb, Farm Foreman, Hawkesbury Agricultural College, speaking about cow peas, says: "As a green manure, the cow pea is invaluable, and as a proof the following statement may be of interest:—Last year (1896) I sowed wheat on a piece of land following cow pea (which had been cut and carted off for threshing), and the growth of that wheat was most marked. Indeed, it was so strong and luxuriant that the plants swayed down, making the cutting very difficult. Without doubt the value of cow pea as a fertiliser cannot be over-estimated."

The Nomenclature of Fruits.

Frequent complaints have been made to the Department of Agriculture by persons who have purchased fruit trees, that, after the expense of planting them and waiting for years, during which they have been put to the expense of cultivating and tending to them, it is found that the fruits frequently turn out to be worthless varieties, unfit for market or even for home use. As it is almost impossible to determine what variety a tree really is until it bears fruit, it can readily be seen how much distress and loss may be caused to fruit-growers. One writer, after relating how he has been victimised in the past, says: "I have inquired of most of the Sydney firms, and none of them care to give a guarantee that the trees are true to name, but say they will send them as near as they can."

A glaring instance of the suffering caused by the distribution of worthless trees is the experience of many of the settlers at Mildura, who endured great losses, after years of patient waiting, from planting worthless orange trees said to have been obtained in New South Wales. The Department of Agriculture has even been victimised, although endeavouring to take every care, for some of the fruit-trees supplied have turned out to be wrongly named.

Mr. Sydney Smith intends to take action to assist orchardists to remedy this abuse, and at the same time considers that all persons interested should bestir themselves to have the matter placed on a more satisfactory footing; and also considers that co-operation amongst fruit-growers will, to a great extent, assist to put a stop to the serious evil complained of.

Concerning the matter the Fruit Expert, Mr. W. J. Allen, says: "As there are now new varieties of the different fruits being propagated every year which are now taking the place of worthless old varieties, it will be found very difficult for the fruit-growers to keep up to date; but I understand that an effort is to be made in the near future to get correct samples of the different fruits, and have models made of same to be placed on view in the Museum of the Department of Agriculture, Sydney. However, I think that the fruit-grower who makes a study and business of his profession, should, with the information already published in the *Gazette*, and such hints as he picks up from actual experience, be fairly well advised of the different varieties most suited to his district and requirements. I know that there has been considerable difficulty in getting from the nurseryman trees true to name; but there are some who are trying to establish a reputation, and who would not knowingly sell a tree which was not true to name. I would, however, advise keeping to those fruits which are known to be good until the new varieties have been proved.

"The Department of Agriculture has started orchards in different localities, in order to test the quality of the different kinds of fruits; and as soon as

the trees are old enough to bear good fruits, the results will be published, with the names of those kinds which have proven to be the best. In this Colony we have climate similar to that of Victoria, so that we will be profited by learning of any successful experiments made there; and I take it that any information published has been altogether impartial, always keeping in view the requirements of the fruit-growers of this Colony."

Pisé Walls.

Mr. W. J. Pleffer, of Wyndella, Armidale, has furnished the following particulars of building pisé walls with mould boards:—

"How to make a pisé or mud wall.—Procure some ½-inch rod iron; cut it in lengths of 1 ft. 8 in., sixteen lengths in all; make bolt heads on one end, and at 14½ inches and 17½ inches from head punch holes to receive a key. You also want sixteen lengths of flat iron 15 inches long, 1¼ inch wide, by ⅛ inch thick, with a hole punched in each end. Not less than three pairs of boards are required, in lengths of 6, 8, and 10 feet, 1 inch thick by 1 foot wide. Kauri pine is the best, being light and strong. To fix the boards, run a rod through each pair of flat-iron pieces, and if a 1-foot wall is required, put key in 14½-inch hole; if thicker, key the other hole (I prefer outer walls 1 ft. 3 in. thick); rest the boards on the rods; draw the flat pieces up vertically, and insert the other rods; put two sticks crosswise in each box to make them rigid; fill in the mud and ram; smooth each course on top and remove the boards. In two days it will be dry enough to receive another course. A bolt with a nut on it is fixed to the end of one board to turn corners. Any kind of soil excepting clay will do to build with, but the poorer the better. I prefer an ironstone gravel; mix it up soft, and let it stand in a heap for a day or two; it will then ram-in firm, and set like a rock. Window and door frames may be built in, or the openings left and frames fixed in after. Mud walls, whilst being constructed, must be protected from rain."

Pasture Experiments at Wollongbar.

In order to meet the demand for information concerning pastures, caused by the rapid development of dairying in the northern districts, arrangements have been made for a series of experiments at the Wollongbar Experiment Farm. An area of 20 acres has been divided off into four 5-acre blocks, on which will be sown cocksfoot, paspalum, Kentucky blue grass, and a mixture of prairie grass and clovers. By the time that these four trial paddocks are ready for use it is hoped that the establishment of the farm dairy will have been effected, and the respective value of these grasses may be fairly tested. The Manager has had for some years a number of small trial plots, and has grown upwards of 100 varieties, most of them new to the district. Among these Mr. M'Keown mentions that guinea grass (*Panicum maximum*) should prove invaluable for ensilage, a recent cutting from nine-months old plants having yielded at the rate of 25 tons per acre.

Ensilage for Dairy Cattle.

The following details of the Robertson combination for ensilage, prepared and tested by Professor Robertson, of the Canadian Agricultural College, and referred to by Mr. S. Lowe in a paper read in London before the Royal Colonial Institute, may be of interest to dairy farmers in this Colony.

The three crops referred to are easy to grow. Perhaps the bean, *Faba vulgaris*, sometimes called the tick-bean, is not so well known to many of our readers; but, in the absence of that species, the cow-pea should make a good substitute:—

Combination for Ensilage and How to Make it.

The object of the new Robertson combination for ensilage was to get the heat-producing parts, the flesh-forming parts, and fat together in such proportions that the cow would get at every meal a perfectly balanced ration. In this new combination we have Indian corn, horse beans and sunflowers; and it appears to be a perfect combination which will give cattle a food containing all the nourishment required.

Indian corn—the great sun-plant of America—is undoubtedly the most serviceable crop which has been used for ensilage; but although it be ever so well preserved as to succulence, odour, flavour and colour, it is an incomplete food for cattle. With a marvellous proclivity for storing up starch, gum, and sugar out of the elements of the air, the corn-plant becomes a veritable accumulator of sun, strength, and energy. Its carbohydrates or "heat-producing parts" are largely in excess of its albuminoids or "flesh-forming parts." These latter are present in no mean quantities in fodder corn per acre; but, for a wholesome, economical, complete food, they are out of correct proportion to the other constituents.

The horse-bean or small field-bean (*Faba vulgaris*, var. *Equina*) seems to meet the needs of the case. This plant grows with a stiff, erect stem of quadrangular shape. It attains here a height of from 3 to 4 feet; and it grows in England and Scotland to a height of from 3 to 6 feet. It bears pods from within 6 or 8 inches from the base of the stalk to near its top. The ripened beans are of a greyish-brown colour, and of an oblong, round-shape, about ½ inch long diameter and about ⅜ inch in short diameter.

Although albuminoids and carbo-hydrates (in the form of starch, gum, sugar, and fibre) may be contained in an Indian corn and horse-bean mixture in nearly correct proportions, it is still an incomplete food, from deficiency in fat. The sunflower (*Helianthus annuus*) grows luxuriantly over the whole of the temperate zone of this Continent, and the seeds contain a large percentage of fat. The variety known as the "Mammoth Russian" was grown in rows 3 feet apart, with the plants from 3 to 18 inches distant in the rows. There did not appear to be any appreciable difference in the weight of the crop per acre where the plants were grown close or more distant in the rows. They yielded at the rate of 7½ tons of sunflower heads per acre. From the analyses made by Mr. Shutt, it was established that they contained 352 lb. of albuminoids and 729 lb. of fat per acre.

Half-a-bushel of horse-beans are mixed with one-third of a bushel of Indian corn, and are sown or planted on 1 acre, in rows 3 feet to 3½ feet apart. The method of cultivation to be followed is similar to that for the culture of fodder corn. When the corn reaches the glazing stage of growth, the product from 2 acres of the mixture (which being grown together is necessarily handled as one crop) is cut and put into the silo, together with the heads from half an acre of sunflowers. The sunflower heads may be reaped with a common sickle, carried to the cutting-box on a cart or waggon, and put through it, on and with the Indian corn and horse-beans.

The following table shows the quantities of the nutrients which are contained in the crop from 2 acres of Indian corn and horse-beans grown together, and in the heads from half an acre of sunflowers grown separately:—

	Albuminoids.	Carbo-hydrates and fibres.	Fat.
	lb.	lb.	lb.
Indian corn: 15 tons per acre = 30 tons	1,092	10,302	324
Horse-beans: 4·5 tons per acre = 9 tons	490	1,361	125
Sunflower heads: 7·5 tons per acre = 3·75	176	1,186	364
Total	1,758	12,849	813

Two acres of fodder corn, at 15 tons per acre, furnish 1,200 single feeds of 50 lb. each. The albuminoids, in the horse-beans and in the heads from half an acre of sunflowers, are the equivalent of the albuminoids in a quantity of mixed cereals sufficient to give 4½ lb. with every feed of the 1,200. It is to be expected that further experiments will demonstrate that the albuminoids in the horse-beans and sunflowers, being in a succulent

condition, will be more easily and fully digestible than the ripened cereals. The cost to produce the "Robertson Combination for Ensilage" from $2\frac{1}{2}$ acres is \$15 more than the cost for growing 2 acres of Indian corn alone. The extra items are :—Sunflower seed for half an acre; labour of planting, cultivating, and reaping half an acre of sunflowers; and horse-bean seed for 2 acres; total, \$15. Against that outlay of \$15, the return in albuminoids is the equivalent, for the feeding of cattle, of 115 bushels of mixed cereals. I have made no estimate of the value of the large quantity of fat in the sunflower heads.

Poultry Runs.

Last month, in referring to a serious out-break of disease (reported to be chicken cholera) in the yards of a suburban poultry-keeper, a correspondent to the *Daily Telegraph* said that, notwithstanding the fact that the gentleman in question had been most attentive to the requirements of his fowls, and despite elaborate and complete arrangements for their welfare, he had fallen into the common error of overstocking. "To run hundreds of poultry upon the limited area of a suburban allotment," continued the correspondent "for years together without intermission may be done successfully; but the risk is great and if persisted in the calamitous experience that has fallen to this poultry-keeper is inevitable. A precisely similar occurrence happened a short while since to a friend of mine. He kept 300 fowls on an allotment 40 feet by 160 feet. They did well for a year or two—just so long in fact as the soil on which they ran retained its absorbent power. Then, when it became over-burdened, heavy rain liberated its pestilential contents, and in twenty-four hours from the out-break not one bird of the 300 remained alive. Some authorities assert that not more than sixty head of poultry may with safety be run to an acre when it is not cultivated. Of course, opinions on this head may differ, but that is the number allowed on one of the oldest and most successful poultry farms in England."

In the *Agricultural Gazette* for November, 1896, Dr. Cobb, in an article on worms in fowls, laid stress on the importance of changing and spading over the runs. Miss May de Lou, writing on this subject in the *American Agriculturist*, says: "One acre of land gives a good range for 200 fowls. Divide it into two portions with poultry netting; let the flock run on one-half, while the other is culivated, or at least ploughed and sowed down to grass. Poultry will delight in this grass the next spring, when the halves must be altered. Only in some such way will we be able to keep the land sweet and free from disease."

Millets.

For seed and forage millets are worthy of much more attention than is usually devoted to this valuable group. Sown in spring, at the rate of 15 lb. per acre broadcast, or about 10 lb. drilled, millet will produce a heavy yield of palatable and nutritious green fodder. At Wagga Experiment Farm, where Mr. Valder conducted experiments with the seven best known varieties, the German Millet (Salzer's Dakota), Hungarian, Golden Wonder, and Pearl Millet, yielded three cuttings of green stuff in a dry season. The manager of the Wollongbar Experiment Farm, Mr. G. M'Keown, makes excellent chaff of the Hungarian variety, and wherever his example has been followed farmers speak well of the product.

For seed purposes the White French, Golden Wonder, and yellow varieties yielded, at Wagga, 44, 37, and 29 bushels (60 lb.) per acre. In America millets are greatly esteemed, and in a recent number of the *American Agriculturist*, a Kansas farmer says: "I notice here, where much millet is raised, that wherever hens run about millet stacks there is a good egg record.

Suppose you suggest to poultrymen the sowing of German millet for feed in winter. It yields a heavy crop of seed, and the straw is fair cow-feed after the seed is removed. I am buying seed to feed, using one quart per day for sixty hens with three quarts corn, then they get Kaffir seed from the feed lot. I also feed some meat, and have good results, but think more millet and less Kaffir and cane would be better."*

Another American writer on the subject of millet says: "Aside from its feeding value, millet is a very useful crop for clearing the ground of cut-worms. A few years ago the Agricultural Experiment Station of South Dakota sent out questions concerning the cut-worms, one of which follows: Will a crop such as millet, which the worms do not like, and which effectually chokes out all other growth, leave the ground free from worms in the fall? Out of sixty answers received only one reported that worms had followed a thrifty crop of millet. All the others reported that corn after millet stood the best chance of being unmolested by wire-worms."

The cultivation of broom millet has been dealt with in the *Agricultural Gazette* (September, 1896), and the article has been reprinted in pamphlet form for issue to anyone desirous of trying the crop. This millet also yields a large quantity of seed, which is a first-class feed for poultry and pigs.

* Reference was made in the June *Gazette* to the use of sorghum, including the variety called Kaffir corn, for poultry feed. At Wagga, in a series of trials, Mr. Valder found that the variety known as Yellow Branching (having a drooping head) yielded 48 bushels (60 lb.), while the white and red Kaffir corn produced 43 bushels each.

Replies to Correspondents.

Propagating and Raising Fruit-stock of Different Species.

In reply to numerous inquiries, the Fruit Expert, Mr. W. J. Allen, has furnished the following notes on the raising of fruit trees from seed, the preparation and care of seed-beds, use of stocks, etc.:—

Oranges and Lemons.

Orange seedlings make the best stocks for both the orange and lemon, and should be used exclusively. A light loam is best adapted for the seed-bed, which should be enriched with plenty of well-rotted sheep manure. Beds should be about 2 feet wide, and the length according to the shed. It is always advisable to shade the beds for the first season with hessian, calico, or pine brush. The frame is usually made, so that when the covering is on a man can easily walk in under, for the purpose of watering the beds. The seed should be sown thinly over the surface, and covered about 1 inch deep. It is always best to get the beds ready, so that the seeds may be sown in the spring, as soon as possible after they are taken out of the oranges. If seed has to be kept any length of time before sowing, care must be taken that it does not get too dry. It may be kept in water for a short time, but this should be drained off every day and fresh added. The plants are left in the seed-bed until the following spring, when they are planted out into nursery rows 3 ft. 6 in. wide, and 1 foot apart. It is usually two years from the time of planting out, before they are large enough to bud.

Oranges grown on lime stock produce some very fine fruit—in fact, the best Washington Navels I have ever seen, were growing on lime stock; but they will not stand the cold climate so well as orange stock.

Apples.

I would advise any small grower, who wishes to work a few hundred trees each year, to purchase from some thoroughly reliable nurseryman about two dozen Northern Spy apple trees, and plant them in rich soil, where they will make a good growth for a year, then dig them up and cut the roots up into pieces about 4 inches long, and graft with Northern Spy. The following autumn these grafts will have grown into trees large enough to be ready for budding, which can be done in the usual way. Continue growing Northern Spy for stock, as this has been found and proven to be blight-resisting.

Peaches and Nectarines.

The seeds or pits are planted in the fall, in rows 3 ft. 6 in. apart, and pits dropped about every 6 inches, and covered to a depth of 3 inches. Light soil is always preferable for planting seeds. By the following fall they are quite large enough to bud, which is always preferable to grafting. Never bud peach or nectarine on almond or plum stock, as I have never seen trees worked to these make a proper growth, although they will produce a very fine fruit; however, my personal experience has been that they have had to be dug up before many years and planted with peach stock.

Cherry.

The finer sorts are nearly always propagated by budding on seedlings of the common black Mazzard cherry, which is a very common kind, producing a great abundance of fruit and very healthy free-growing stocks. Bird cherry is sometimes used as a stock also. Cherries should be gathered when fully ripe and allowed to stand for a few days, so that they may be more easily freed from the stone by washing them in water. They should then be planted in drills or seed-plots, covering them about 1 inch deep with soil, and a fine coating of manure over the top to keep the soil from baking. They will vegetate the following spring, and in the fall some will be ready to bud. Morello and Mahaleb stocks are frequently used for dwarfing trees, the last mentioned being adapted for shallow, poor soils.

Apricots.

The seeds or pits are planted in the same way as the peach and nectarine seeds, and should be budded almost exclusively on apricot stock. I have seen them grow and bear well on peach stock; but, so far, my experience in Australia has been, that the almond stock is utterly useless, and that it does best and bears best on its own stock.

Walnuts and Almonds.

The nuts are put in in the fall, in the same way as the peach-stones, and the following autumn will be large enough to bud.

Plums.

Seedlings are raised in large quantities for stocks, and the cherry plum is in great demand for this purpose. They should be planted in the fall, in the same way as peach pits, and will be ready for budding the following autumn.

I would recommend planting all stones, pits or nuts, in as rich and light soil as possible, as they come up more readily and make a better growth.

Crops for Pig Fodder.

Mr. F. W. A. Downes, of Brownlow Hill, Camden, writes:—"I was much interested in reading a short article on "Leguminous Crops for Pigs" amongst your general notes in issue for July. I am anxious to identify the soja bean spoken of by Mr. Wilson. Can you inform me if this bean is grown in the Colony; and if so, under what name? I am giving attention to pig-farming on the American system; and so far I have met with very encouraging results. I am using wire netting, manufactured in the Colony, for enclosing my pig paddocks and I consider it makes the cheapest and best fence. I am most anxious now to find out the most desirable grain crops to grow for feeding off the paddock, and any information on the subject will be of the greatest interest to many."

In reply, Mr. George Valder, Principal of the Hawkesbury Agricultural College, states: "Soy bean (illustrated in *Agricultural Gazette*, page 648, 1891; and "Farmers' and Fruit-growers' Guide," page, 193) succeeds well in the warm, moist parts of the Colony, and should make a profitable pig feed; but I do not consider it equal to cow-pea for that purpose. I would take maize, dwarf varieties of sorghum—such as Kaffir Corn, Egyptian Dhoura, and Yellow Branching—mangolds, cow-pea, and lucerne, as the best summer feed. For winter, I would recommend rape, barley, peas, lucerne, and turnips."

Vessels for Mixing Sprays.

A FAIRFIELD correspondent writes:—"Last week I started to make a winter dressing of sulphur, lime, and salt for my orchard, as per directions given in the *Gazette*, and the insect pest chart issued by the Department. I put the exact quantities of sulphur, lime, and water in a new copper boiler, and proceeded to boil as directed. In about half-an-hour the bottom of the boiler dropped out, eaten or corroded away by the mixture. I would like to know the cause of this, and also the chemical action that took place."

Mr. F. B. Guthrie, Chemist to the Department, in reference to this matter, says:—"Copper vessels should on no account be employed for this purpose, as sulphur attacks copper readily under these circumstances. Vessels of iron, or of tinned iron, can be safely employed. They will, however, be blackened, and not easily cleaned. The best sort of vessel to use, if available, is one enamelled internally; but, of course, such vessels would be rather expensive. Oil and soda drums are about the cheapest vessels procurable."

Mr. Guthrie is now preparing for publication in our next issue some notes on the effects of mixing the ingredients used in the various spraying formulæ, their action on different kinds of vessels, and the precautions to be taken.

Rape for Green Manure.

MR. D. M'KERRELL, of Chatsbury, asks for information as to the time for sowing, and best variety of rape for green manure.

Mr. Geo. Valder, Principal of the Hawkesbury Agricultural College, would recommend sowing in February or March. Dwarf Essex variety has so far given the best results.

How Beetles Breed from Old Trees.

A NUMBER of correspondents have asked for information as to where borers and other longicorn beetles come from in places that have apparently been cleared of all insect life.

The Entomologist, Mr. Froggatt, says:—"Towards the end of last year, I cut down a large Queensland chestnut tree (*Castanosperum australe*) in my garden. The trunk and branches were thrown into the yard where they remained until quite recently. Upon examining them I found that the dead limbs were riddled with borers, and upon splitting several branches down the centre, I found them swarming with the pupæ and fully developed elephant beetles. There were some thousands of these insects, and in the natural course they would have emerged in the spring. This is an instance of how dangerous it is to leave dead or dying trees in an orchard or garden. Many beetles seem to have a wonderful instinct that leads them to a tree as soon as decay sets in, and this is specially noticeable where the bark is just commencing to peel off a dying tree. If all garden shrubs and fruit trees were burnt soon after they were cut down or dug out, the birth of an immense number of wood destroying insects could be prevented."

Linseed.

MR. JAMES MCRAE, of Barrington, asks for information *re* the growing of linseed.

Mr. Geo. Valder, Principal of the H. A. College, reports that the Barrington district should be very suitable for linseed, especially on the friable loams. He is of opinion that the best crops would be obtained by sowing in the

autumn, although fair crops could be procured by spring sowing. In growing flax for seed it is advisable to sow half to 1 bushel per acre, and for fibre 2 to 3 bushels per acre. Clean and thorough cultivation is necessary for a successful crop. Seed can be obtained from any reliable seedsman at about 3d. per lb.

A special article on flax-culture appeared in the *Agricultural Gazette*, vol. II, page 85.

Lucerne on Granitic Soils.

MR. R. O'REILLY, of Goolaberbon, *via* Megalong, writes: "My land is a coarse granite and hilly. Could you tell me if it would grow lucerne as a feeding crop. I would sow largely of it if I knew I would be fairly successful in the venture. I do not know that it has ever been tried in this district. My place is situated about 14 miles south of Mount Victoria, on the River Cox. Wheat, oats, maize, potatoes, and sorghum grow very well."

Mr. Geo. Valder, Principal, H. A. College, reports that fairly rich granitic soils are suitable for lucerne growing, especially if deeply cultivated. If the land is poor, it will be necessary to manure by ploughing in well-rotted stable manure, mixed with wood ashes or kainit. For successful lucerne growing the chief point is deep and thorough cultivation. The climate should be suitable.

Carbonate of Copper.

MR. WM. STOLLARD, of Sunnyside, Lower Corowa, writes:—

"(1.) Will your Department please inform me whether there is any known test for home-made carbonate of copper? I note by last issue of *Gazette* that there are two qualities of bluestone on the market, and anyone wishing to use same may not have time to get them analysed. I wish also to point out that some directions for making copper carbonate recommend carbonate of soda, while others recommend washing soda.

"(2.) If washing soda is used, how does the compound become carbonate of copper? Are washing soda and carbonate of soda one and the same?

"(3.) I also wish to be informed whether or not washing soda undergoes a change when kept exposed to the air?

"(4.) I followed out the directions in the *Gazette* for making carbonate of copper, but I find that it does not form a paste, only a milky-like fluid.

"If possible make a note of the above in the *Gazette*, and thereby oblige others and self."

The Chemist, Mr. F. B. Guthrie, reports:—

(1.) Carbonate of copper is a pale blue powder, which should dissolve readily, with effervescence, in any dilute acid, to a light blue solution. It should dissolve completely, but not quite so readily, in ammonia, forming a solution of an intense blue. It is better to test the bluestone (sulphate of copper) before using. Bluestone should be in the form of dark blue crystals, soluble in water—especially warm water—forming a blue solution. When ammonia is added to the solution in water, a light blue coloured precipitate is formed at first, which dissolves on adding more ammonia to an intense blue solution. This solution should be quite clear, and on standing should not form a deposit or sediment. If a reddish-coloured sediment appears, it shows the presence of iron. Bluestone dissolves, but does not effervesce, in acids.

(2.) Washing soda and carbonate of soda are identical.

(3.) Crystals of washing soda on standing exposed to the air become covered with a fine white powder, and will in time crumble away to powder. The reason being that the crystals contain a large proportion of water (formula is $Na_2\ Co_3 + 10\ H_2O$). This water is slowly given off to the air, and a compound, containing $\frac{1}{10}$th. the quantity of water, the so-called monohydrate (formula $Na_2\ Co_3 + H_2O$) is produced, which is the white powder referred to.

(4.) The mixture, if made according to any directions I have seen, should not form a paste, but a milky solution, from which the carbonate of copper is deposited on standing. You are usually directed to wash this deposit by siphoning off the water, washing the deposit with hot water, allowing to deposit again, siphoning off water a second time, and then drying the residue. The residue will, no doubt, be in a pasty condition when the water is siphoned off.

Mr. Guthrie adds:—"With regard to the two qualities of bluestone, I should be glad if anyone who obtains bluestone of a pale blue colour would send me some, and note the supplier. The substance to which attention was drawn was not a mixture of crystals of copper sulphate and ferrous sulphate, but crystals of the double sulphate of copper and iron, showing that it had been manufactured purposely by dissolving copper sulphate and adding solution of ferrous sulphate and crystallising out. This is a process of adulteration which it would hardly pay to resort to except on a large scale."

On Her Majesty's Service.

The Department of Agriculture,

SYDNEY.

SPECIMENS ONLY.

From ....

Address ....

(By authority of the Department of Mines and Agriculture.)

AGRICULTURAL SOCIETIES' SHOWS, 1897.

Society.	Secretary.	Date.
Dapto A. and H. Society	A. B. Chippendall	Jan. 6, 7
Albion Park A. and H. Association	H. Fryer	" 13, 14
Gosford A. and H. Association	W. McIntyre	" 29, 30
Wollongong A. and H. Society	J. A. Beatson	Feb. 3, 4
Cobargo A., P., and H. Society	T. Kennedy	" 16, 17
Ulladulla P. and A. Society	C. A. Cork	" 16, 17
Berrigan A. and H. Society	R. Drummond	" 17
Riverina P. and A. Society (Cereal)	W. Elliott	" ——
Manning R. (Taree) A. and H. Association	H. Plummer	" 18, 19
Lithgow A., H., and P. Society	J. Asher	" 18, 19
Robertson Agricultural Society	R. J. Ferguson	Mar. 2, 3
Bega A., P., and H. Society	J. Underhill	" 3, 4
Southern New England (Uralla) P. and A. Association	Jas. Leece	" 9, 10
Tumbarumba P. and A. Society	W. Willans	" 9, 10
Tenterfield Intercolonial P., A., and M. Society	F. W. Hoskin	" 10, 11, 12
Coonabarabran P. and A. Association	E. May-Steers	" 11
Oberon A., H., and P. Association	A. Gale	" 11, 12
Berrima District (Moss Vale) A., H., and I. Society	J. Yeo	" 11, 12, 13
Cobargo A., P., and H. Society	T. Kennedy	" 16, 17
Crookwell P. and A. Association	W. P. Levey	" 18, 19
Lismore A. and I. Society	T. M. Hewitt	" 18, 19
Walcha P. and A.	F. Townsend	" 23, 24
Cudal A. and P. Society	C. Schramme	" 24, 25
Blayney A. and P. Association	J. Clements	April 1, 2
Mudgee A., P., H., and I. Association	J. Cox	" 6, 7
Liverpool Plains (Tamworth) P., A., & H. Association	A. M'Leod	" 6, 7, 8
Warialda P. and A. Association	W. B. Geddes	" 7, 8
Williams River A. and H. Association	W. Bennett	" 7, 8
Cooma P. and A. Society	D. C. Pearson	" 7, 8
Orange A. and P. Association	W. Tanner	" 7, 8, 9
Gulgong P. and A. Association	C. E. Hilton	" 13, 14
Queanbeyan P. and A. Association	W. D. Wright	" 13, 14
Royal Agricultural Society	F. Webster	" 14-20
Moree P. and A. Society	S. L. Cohen	" 21, 22
Clarence P. and A. Society (Grafton)	J. Wilcox	" 27, 28
Bathurst P. and A. Society	W. G. Thompson	" 28, 29, 30
Hunter River (West Maitland) A. and H. Association	W. C. Quinton	" 28, 29, 30
Hay Hortic. Society	J. Johnston	May 5
Namoi P. and A. Association (Narrabri)	J. Riddle	" 5, 6
Hawkesbury District Agricul. Association (Richmond)	C. S. Guest	" 6, 7, 8
Upper Manning A. and H. Society	W. Dimond	" 12, 13
Wellington P. and A. Society	R. Porter	" 13, 14
Upper Hunter P. and A. (Muswellbrook)	J. C. Luscombe.	" 19, 20, 21
Nyngan and District	E. H. Prince	June 1, 2
Brewarrina P. and A. Association	H. L. Cathie	" 7, 8
Cobar P. and A. Association	W. Redford	" 9, 10
Deniliquin P. and A. Society	H. J. Wooldridge	July 13, 14
Hay P. and A. Association	Chas. Hidgcock.	" 22, 23
Riverina P. and A. Society (Jerilderie)	W. Elliott	" 27, 28
Condobolin P. and A. Association	H. W. Grey Innes.	" 28, 29
Lachlan P. and A. Association (Hillston)	Thos. Cadell	" 30
Gunnedah P., A., and H. Association	J. H. King	Aug. 3, 4
Forbes P., A., and H. Association	F. Street	" 5, 6
Corowa P., A., and H. Society	E. L. Archer	" 19, 20
Cootamundra A., P., H., and I. Association	T. Williams	" 25, 26
Grenfell P., A., H., and I. Association	G. Cousins	" 25, 26
Northern Agricultural Association	C. Poppenhagen	Sept. 1, 2
Murrumbidgee P. and A. Association (Wagga)	P. W. Lorimer.	" 1, 2

Society.	Secretary.	Date.
Burrawong P. and A. Association (Young)	C. Wright ...	,, 1, 2
Manildra Agricultural Society ... ... (Ploughing Match and Horse Parade.)	G. W. Griffiths..	,, 8
Albury and Border P., A., and H. Society	Geo. E. Mackay	,, 8, 9
Murrumburrah P., A., and I. Association	Miles Murphy...	,, 8, 9
Yass P. and A. Association	Thos. Bernard...	,, 9, 10
Wallsend and Plattsburg A. H. P. P. and C. Society ...	G. Gilmour ...	,, 9, 10, 11
Junee P., A., and I. Association	T. C. Humphrys	,, 15, 16
Burrowa P., A., and H. Association	J. H. Clifton ...	,, 16, 17
Cowra P., A., and H. Association	Fred. King ...	,, 22, 23
Temora P., A., H., and I. Association	W. H. Tubman.	,, 22, 23
Moama A. and P. Association	C. L. Blair ...	,, 29
Narrandera P. and A. Association	J. F. Willans ...	Oct. 6, 7
Berry Agricultural Association	A. J. Colley ...	Nov. 24, 25, 26

1898.

Society.	Secretary.	Date.
Dapto A. and H. Society	A. B. Chippendall	Jan. 12, 13
Albion Park A. and H. Association	H. Fryer ...	,, 19, 20
Kiama A. Association	J. Somerville ...	,, 25, 26
Alstonville Agricultural Society	H. R. Elvery ...	Feb. 1, 2
Wollongong A., H., and I. Association	J. A. Beatson ...	,, 2, 3
Robertson Agricultural Society	R. G. Ferguson..	,, 8, 9
Shoalhaven A. and H. Association	R. C. Leeming...	,, 10, 11
Manning River A. and H. Association (Taree)	H. Plummer ...	,, 10, 11
Moruya A. and P. Society...	John Jeffery ...	,, 11, 12
Ulladulla A. and H. Association (Milton)	C. A. Cork ...	,, 16, 17
Kangaroo Valley A. and H. Association...	W. Randall ...	,, 17, 18
Tumut A. and P. Association	B. Clayton ...	,, 26, 27
Southern New England P. and A. Association (Uralla)	J. D. Leece ...	Mar. 1, 2
Bega A., P., and H. Society	J. Underhill ...	,, 2, 3
Upper Hunter (Muswellbrook) P. and A. Association...	J. C. Luscombe.	,, 2, 3, 4
Bombala Exhn. Society	R. H. Cook ...	,, 8, 9, 10
Tenterfield Intercolonial P., A., and M. Society ...	F. W. Hoskin...	,, 9, 10, 11
Cudal A. and P. Society	C. Schramme ...	,, 10, 11
Crookwell P. and A. Association	M. P. Levy ...	,, 10, 11
Inverell P. and A. Association	I. McGregor ...	,, 10, 11, 12
Berrima District (Moss Vale) A. H. and I. Society ...	J. Yeo	,, 10, 11, 12
Armidale and Glen Innes Combined New England District Show at Armidale.	J. Allingham ...	,, 16, 17, 18
Cumnock P. and A. Association	Thos. Howard...	,, 17
Blayney A. and P. Association	G. Pile, junr. (acting).	,, 17, 18
Goulburn A., P., and H. Society	J. J. Roberts ...	,, 17, 18
Walcha P. and A. Association	F. Townshend...	,, 22, 23
Namoi P., A., and H. Association	J. Riddle ...	,, 23, 24
Central Richmond (Coraki)	D. Cameron ...	,, 24, 25
Camden A., H., and I. Society	W. R. Cowper...	,, 23, 24, 25
Bathurst A., H., and P. Association	W. G. Thompson	,, 23, 24, 25
Liverpool Plains P. A. and H. Association (Tamworth)	A. C. M'Leod...	,, 29, 30, 31
Macleay A., H., and I. Association	J. M'Maugh ...	,, 30, 31, and April 1.
Orange A. and P. Association	W. Tanner, junr.	,, 30, 31, April 1
Molong A. and P. Association	P. F. A. Kinna..	April 5, 6
Warialda P. and A. Association	W. B. Geddes...	,, 6, 7
Royal Agricultural Society of N.S.W.	F. Webster ...	,, 6–12
Richmond River A., H., and P. Society (Casino) ...	Jas. T. Tandy...	,, 14, 15
Moree P. and A. Society	S. L. Cohen ...	,, 27, 28
Dubbo P. A. and H.	H. Munckton ...	,, 26, 27
Gunnedah P. and A. Association	J. H. King ...	,, 26, 27
Hawkesbury District Agricultural Association	C. S. Guest ...	May ——

Secretaries of Societies are asked to forward dates of forthcoming Shows as soon as decided.

[Five **plates.**]

Panicum semialatum, R. Br.

"The Half-winged Panic Grass."

Useful Australian Plants.

By J. H. MAIDEN,
Government Botanist and Director of the Botanic Gardens, Sydney.

No. 45.—The Half-winged Panic Grass (*Panicum semialatum*, R. Br.)

Botanical name.—*Semialatum*, half-winged, from the Latin *semi* half, and *alatum* winged, perhaps in allusion to the membranous outer glume, which is about half the length of the spikelet.

Vernacular name.—"Cockatoo Grass" of parts of Queensland, in allusion to the fact that these birds feed on the grain.

Botanical description (*B. Fl.* vii., 472).—

Stems erect, 2 to 3 feet high, silky-pubescent about the nodes, otherwise glabrous, or nearly so.

Leaves narrow, with involute margins or subulate, usually pubescent, the lower ones sometimes densely clothed with long silky hairs.

Panicle 3 to 6 inches long, consisting of two to five long erect or slightly diverging branches clustered at the end of a long peduncle.

Spikelets 2 to 2½ lines long, few together, in erect clusters on short branches along the rhachis.

Glumes all ending in a short subulate point, the outer one membranous, three-nerved, about half the length of the spikelet; the *second glume* the largest, membranous, five-nerved, fringed on each side with long pale or dark-coloured hairs, spreading in fruit and connected at the base on the intramarginal nerve; *third glume* more rigid, though thin, with a small palea and sometimes three stamens in the axil.

Fruiting glume more rigid, with a rather longer point; the palea also rigid, but the inflexed margins thin, with a distinct lobe at the base on each side.

Value as a fodder.—A strong-growing, useful grass, much relished by stock, particularly when young and tender.

Other uses.—Lumholtz found this grass in Northern Queensland to form the principal food of white cockatoos. (Bailey.)

Habitat and range.—Extends from this colony to Queensland and Northern Australia, from the Liverpool Plains northerly and westerly to the dry country. O'Shanesy says that (in Queensland) it indicates a poor clay soil. It is also found in Africa, and in tropical Asia from Ceylon and the Indian Peninsula to the Malayan Archipelago and South China.

Reference to Plate.—A, Portion of a panicle; B, Spikelet, showing relative size of outer glume; C, Spikelet dissected, showing outer glume, second and third glume, and fruiting glume, with its palea; D, Part of fruiting glume, tipped with a minute point, and minutely transversely rugose.

No. 46.—*Panicum adspersum*, Trin.

Botanical name.—*Adspersum*, Latin for besprinkled or scattered, referring to the scattered hairs on the spikelets.

Botanical description (*B. Fl.* vii, 481).—

Stems ascending to 1 foot or rather more, glabrous except the ciliate nodes.

Leaves flat, rather broad and short, the sheaths broader upwards, prominently ciliate, the lamina almost cordate at the base, with a very short ciliate ligula.

Panicle narrow, rather dense, 1½ to 3 inches long, with several erect and slightly spreading branches, all glabrous, without any or with very few small cilia under the spikelets.

Spikelets ovoid, rather acute, quite glabrous, 1½ to nearly 2 lines long, crowded or clustered in the lower part of the branches, singly sessile towards the end.

Outer glume one quarter to one third as long as the spikelet, rather acute, one or three-nerved ; *second* and *third glumes* nearly equal, the *second* broad, usually prominently seven-nerved, the *third* narrower, with about five nerves, and enclosing a long palea.

Fruiting glume tipped with a minute point and minutely transversely rugose.

Value as a fodder.—This is a leafy and free-seeding grass, and doubtless produces a fairly bulky quantity of nutritious fodder. At the same time the records and observations in regard to its value for grazing are scanty in the extreme.

Habitat and range—In the interior districts of this colony and also of South Australia and Queensland. Found also in the West Indies (San Domingo.)

Reference to plate.—A, Part of panicle ; B, Spikelet, showing the relative size of the outer glume (which is three-nerved) ; C, Spikelet dissected, showing outer and second (the largest) glume, the third glume, also, the fruiting glume and palea.

Panicum adspersum, Trin.

Some Native Australian Fodder-plants

(OTHER THAN GRASSES AND SALT-BUSHES).

J. H. MAIDEN.

OWING to the severity of the droughts, and, in some districts, the competition of rabbits and other vermin, cattle and sheep in Australia have at times to endeavour to preserve existence by devouring any vegetable matter whatsoever. The plants eaten by stock, therefore, embrace a very large number of species; but I have confined myself in the following pages to references to the plants usually eaten, either because they are abundant, or because they readily withstand the drought, or because stock are very partial to browsing upon them.

Notes on the plants eaten by stock (whether from inclination or necessity), with good or bad results, the distribution of them, together with any particulars bearing on their use as fodder-plants, are much required, as the systematic recording of such information is even yet, as far as Australia is concerned, in its infancy.

Most of these plants have no common names, so one is compelled to use the botanical ones.

CRUCIFERÆ.

Lepidium ruderale, Linn. *Lepidium papillosum*, F. v. M.

"These plants grow abundantly after rains, and are first-class fodder-plants. I have known horses working hard and keeping their condition, and subsisting principally on these plants. Where fowls are kept these plants are valuable, as they stimulate, and the seeds are good for food."—P. CORBETT, Mount Browne.

Both these plants, which belong to the Cress family, are found all over the colonies.

CAPPARIDEÆ

Apophyllum anomalum, F. v. M.

A "Native Currant." Usually known as "Warrior Bush," a corruption of the aboriginal name "Wareah."

A useful fodder-plant for stock; usually a bush growing from 6 to 10 feet high.

Interior of New South Wales and Queensland.

PITTOSPOREÆ.

Pittosporum phillyræoides, DC.

Called variously "Butter Bush," "Willow Tree," and "Native Willow."

In times of scarcity this tree is of great value, as it withstands the drought, and sheep and cattle browse upon its foliage. Stock are so partial to it in

the interior districts that it is in danger of extermination in parts, and it is a tree which should be conserved.

All the colonies, except Tasmania, in the drier districts.

Bursaria spinosa, Cav.

"Native Boxthorn."

It is greedily eaten by sheep, but its thorny character preserves it from extinction upon sheep runs. It is very variable in bulk; usually a small shrub, in congenial localities it develops into a small tree. It is also valuable as a shelter for native grasses and other small fodder-plants, which might otherwise be eaten out.

All the colonies.

PORTULACACEÆ.

Claytonia (Calandrinia) balonnensis, Lindl.

Well known as "Periculia" (sometimes spelt "Parakilya,") the aboriginal name in Central Australia. This and allied plants, such as *Portulaca*, go under the name of "Munyeroo."

The occurrence or absence of this plant on the ridges often determines the route of mobs of cattle in the interior. Mr. S. Dixon states that a large mob of cattle, destined to stock a Northern Territory run, travelled some 200 miles without a drink, which would have been absolutely impossible in the absence of this succulent plant.

Interior of South Australia, New South Wales, and Queensland.

Claytonia polyandra, F. v. M.

"Coonda" of the aboriginals about Shark's Bay, Western Australia.

Sheep can largely feed on this succulent shrub for a considerable time without drinking water. (Mueller and Forrest, ***Plants Indigenous about Shark's Bay, W. A., 1883.***)

Interior of New South Wales, South-Western and Northern Australia.

Portulaca oleracea, Linn.

"Purslane," or "Pigweed"; "Munyeroo" of the aborigines.

This is the plant whose seed forms an article of food for the aborigines.

It is a prostrate, succulent plant which stock devour readily; it is also reputed to be nutritious. It is one of those plants which are alike food and drink.

Not endemic in Australia. Found in all the colonies except Tasmania.

MALVACEÆ.

Malvastrum spicatum, A. Gray.

Some squatters have considered this a valuable sheep-feed. (Bailey.) It has been sent as a fodder plant from the Wilcannia district. This plant is not endemic in Australia.

South Australia, New South Wales, and Queensland.

Sida corrugata, Lindl.

Sent as a good forage plant from the Parkes district. Other species of *Sida* (and *Abutilon*), other than enumerated, are doubtless of some value as fodder plants.

Found in all the colonies except Tasmania.

Sida rhombifolia, Linn. (Syn. *S. retusa*, Linn.)

The well-known "Paddy' Lucerne," or "Queensland Hemp."

A well-known fodder-plant of warm countries, including Queensland, and having some value in this direction on the northern rivers, but a stunted plant in cooler parts of the colony, where it becomes a noxious weed. For a full account, with a figure, of this plant, see the *Agricultural Gazette* for August, 1894.

Queensland and New South Wales.

Hibiscus heterophyllus, Vent.

"Green Kurrajong." "Dtharang-gange" is an aboriginal name.

The leaves, branches, and bark of this tree are greedily eaten by cattle in winter. They are mucilaginous, in common with other plants of this natural order.

New South Wales and Queensland.

Gossypium Sturtii, F.v.M.

"Sturt's Desert Rose."

This plant affords stock a good summer feed. (S. Dixon.)

Interior of South Australia and New South Wales.

STERCULIACEÆ.

Sterculia diversifolia, G. Don. (Syn. *Brachychiton populneum*, R.Br.)

"Kurrajong," or "Black Kurrajong"; the "Bottle Tree" of Victoria.

Cattle and sheep are fond of the leaves and branches, and in some dry seasons have existed for long periods on scarcely anything else.

The Kurrajong and Quandong trees are exempted from the operations of all timber licenses and permits in New South Wales, and cutting them down is prohibited; but, in time of drought, if the leaves of the Kurrajong tree are required for feed for stock, the lighter branches may be lopped.

Victoria, New South Wales and Queensland.

GERANIACEÆ.

Geranium dissectum, Linn.

"Crowfoot," and *Erodium cygnorum*, Nees.

Both prostrate plants, often found in grass land and in stony places. They are eaten by stock, and are supposed to be nutritious.

They are found in all the colonies.

RUTACEÆ.

Boronia microphylla, Sieb.

A specimen of this plant was sent to me from Katoomba, labelled "Mountain Hop-bush," with the information that stock are fond of it.

Found in New South Wales and Queensland.

Geijera parviflora, Lindl.

"Wilga," "Sheep-bush," "Dogwood," and "Willow."

Mr. S. Dixon states that sheep only are particularly fond of this bush, and it seems quite unaffected by droughts. It is a very shapely shade-tree.

"The bronze-winged pigeons and other game live on the seeds, and domestic poultry will readily eat them. . . . . With considerable knowledge of bushcraft, I never knew domestic live stock by any mistake to touch it." (A. N. Grant, Hillston.)

MELIACEÆ.

Cedrela toona, Roxb. (Syn. C. *australis*, F.v.M.)

"Red Cedar." Called "Polai" by the aborigines of Northern New South Wales; "Mumin" or "Mugurpul," by those about Brisbane; and "Woota" by those about Wide Bay, Queensland.

The leaves are used to feed cattle in India. (Gamble.) It should be observed, however, that Baron Mueller differs from Bentham in considering the Australian "Cedar" specifically distinct from the "Toon" of India. In any case the trees are so closely related that any property possessed by the one is shared by the other.

New South Wales and Queensland.

Flindersia maculosa, F.v.M.

"Spotted Tree," "Leopard Tree."

During periods of drought sheep become exceedingly fond of the leaves of this tree, which they greedily devour, as well as the twigs up to the size of a goose-quill, and hence the tree is in danger of extermination, as it has not the recuperative power of some trees. This tree in particular should only be pollarded.

Western New South Wales and Queensland.

Owenia acidula, F.v.M.

The "Colane," or "Native Nectarine."

It has been claimed that this is the handsomest tree in the interior; certainly it is a very beautiful, small tree. Mr. Stock Inspector Dulhunty writes that it is one of the best of our fodder-trees.

Found in the interior of South Australia, New South Wales, and Queensland.

RHAMNEÆ.

Ventilago viminalis, Hook.

"Supple Jack." "Thandorah" of the aborigines of the Cloncurry River (North Queensland).

The leaves are eaten by stock.

South Australia, New South Wales and Queensland.

Zizyphus jujuba, Lam.

"Jujube Tree."

The leaves are much valued for cattle-fodder in India.

Queensland.

Pomaderris apetala, Lab.

See a note on this plant's value for forage in the *Gazette* for August, 1897.

Pomaderris racemosa, Hook.

The leaves when chewed or soaked are found to be slightly mucilaginous. This explains the fondness that stock have for this plant. It always seems fresh and green, and stands stocking well. (S. Dixon.)

It has been reported by other observers in South Australia as a fodder-plant, being much liked by stock of all kinds.

All the colonies except Western Australia and Queensland.

SAPINDACEÆ,

Atalaya hemiglauca, F.v.M.

"Cattle Bush," "White-wood."

The leaves of this tree are eaten by stock, the tree being frequently felled for their use during seasons of drought.

South Australia, New South Wales, and Queensland.

Dodonæa lobulata, F.v.M.

"Hop-bush."

One of the best fodder shrubs in the Lachlan district of New South Wales. The seed pods in particular contain a very pleasant bitter. There is no reason to suppose that this particular species is preferred by stock to some others of the genus.

Southern and Western Australia, New South Wales, and Victoria.

Heterodendron oleæfolium, Desf.

"Rosewood" or "Lachlan Emu Bush," "Jiggo" and "Berrigan" (of which "Behreging" is an old spelling), are aboriginal names. (Kidston.)

The seeds, which are covered with a red fleshy arillus, are eaten by emus. Mr. S. Dixon states that both sheep and cattle feed greedily upon it.

It is difficult to kill, springing from the roots when cut down, and one of the best for sheep feed. It grows to a girth of 15 inches and more, and up to a height of 20 feet.

All the colonies except Tasmania (in the interior).

LEGUMINOSÆ.

Acacia aneura, F.v.M.

"Mulga."

By some called the "King of fodders." For illustration and full particulars, see the *Gazette* for August last.

Acacia doratoxylon, A. Cunn.

"Spearwood," a "Brigalow," "Currawang" or "Caariwan," "Hickory."

The leaves are eaten by stock.

All the colonies except Tasmania and Western Australia.

Acacia implexa, Benth.

A "Hickory."

In southern New South Wales, near Delegate, cattle have been known to eat the leaves of this tree, stripping off all within reach, although grass in the paddock was abundant.

Victoria, New South Wales, and Queensland.

Acacia longifolia. Willd.

"Golden Wattle" of the Coast Districts.

In southern New South Wales it has been observed that horses and cattle eat the young shoots, even when grass is by no means scarce.

Found in all the colonies except Western Australia.

Acacia pendula, A. Cunn.

"Weeping" or "True Myall." Called "Boree" and "Balaar" by the aboriginals of the Western Districts.

Stock, especially sheep, are very fond of the leaves of this tree, especially in seasons of drought, and for this reason, and because they eat down the seedlings, it has almost become exterminated in parts of the colonies. Horses do not like it.

New South Wales and Queensland.

Acacia salicina, Lindl.

"Native Willow," and "Broughton Willow," near the Broughton River (S.A.) Called "Cooba" or "Koobah" by the aborigines of Western New South Wales, and "Motherumba" by those on the Castlereagh River, New South Wales.

The leaves are eaten by stock. This is another tree which is rapidly becoming scarce, owing to the partiality of stock to it.

All the colonies except Tasmania.

Albizzia basaltica, Benth.

"Dead Finish."

Cattle like the foliage of this tree.

Queensland.

Albizzia lophantha, Benth.

Cattle browse on the leaves of this tree. It is of rapid growth.

Western Australia.

Cassia eremophila (nemophila), A. Cunn.

Mr. S. Dixon states that both the pods and the leaves of this plant are eaten by stock.

In all the colonies except Tasmania.

Daviesia spp.

"Hop-bush."

Some of these shrubs are called "Hop-bushes" on account of the pleasant bitter principle which pervades them. Horses and cattle are fond of browsing on them.

Speaking of the recent drought in the County of Dampier, Mr. Forester Allan reported that stock ate it *(D. corymbosa)* ravenously, and it kept them alive.

Chiefly in Western Australia, but also in New Souh Wales and other colonies.

Galactia tenuiflora, Wight et Arn.

Mr. Nicholas Holtze, of Port Darwin, informs me that horses are very fond of the foliage.

Glycine tabacina, Benth.

"A very fine fodder"; called "Purple Clover," according to a correspondent n the Parkes district.

G. tomentosa, Benth.

Has been similarly commended.

Both species are found in South Australia, New South Wales, and Queensland; the former in Victoria and Western Australia in addition.

Jacksonia scoparia, R.Br.; var. *macrocarpa*.

A "Dogwood."

Cattle and horses relish the foliage of this small tree amazingly. (Mueller.)
Western Australia.

Psoralea tenax, Lindl.

Considered a good fodder by some. (Bailey.)
New South Wales and Queensland.

Sesbania ægyptiaca, Pers.

"Ngeen-jerry" of the aborigines of the Cloncurry River (North Queensland).

The leaves and branches are cut for cattle-fodder in India. (Gamble.)
Northern Australia.

Swainsona phacoides, Benth.

"Indigo" or "Liquorice."

Considered a most valuable fodder plant in the Walgett district.
Found in all the colonies except Tasmania.

Templetonia egena, Benth.

For a note on this species as a fodder-plant, see the *Gazette* for August, 1897.

Found in the interior of all the colonies except Tasmania.

Trigonella suavissima, Lindley.

From its abundance in the neighbourhood of Menindie it is sometimes called "Menindie Clover." It is the "Australian Shamrock" of Mitchell, and the "Calomba" of the natives of the Darling.

This perennial, fragrant, clover-like plant is a good pasture herb. Sir Thomas Mitchell (*Three Expeditions*) speaks of it in the highest manner as a forage plant on several occasions.

Interior of Australia, from the Murray River and tributaries to the vicinity of Shark's Bay, Western Australia.

MYRTACEÆ.

Angophora intermedia, DC.,

"Narrow-leaved Apple-tree."

Found in Victoria, New South Wales, and Queensland.

Angophora subvelutina, F.v.M.

"Broad-leaved Apple-tree."

New South Wales and Queensland.

Are sometimes cut down to keep cattle alive in dry seasons, as the leaves are relished by them. They are commonly pollarded for the same purpose.

Barringtonia acutangula, Gærtn.

Brandis (*Forest Flora of India*) states that the bark of this tree, mixed with pulse and chaff, is given as cattle fodder in India.
Northern Australia.

Eucalyptus coriacea, A. Cunn. (Syn. *E. pauciflora*, Sieb.).

"White Gum," "Cabbage Gum."

The leaves of this tree are very thick, and in dry seasons are eaten by cattle. (Woolls.) Opossums have a predilection for the young foliage of this tree, so that they often kill trees of this species.

Tasmania, Victoria, and New South Wales.

Eucalyptus corynocalyx, F.v.M.

"Sugar Gum."

The sweetish foliage of this tree is browsed upon by cattle and sheep. In this respect this eucalypt may be classed with one other, *E. Gunnii*. (J. E. Brown.)

South Australia.

Eucalyptus Gunnii, Hook, f.

"White Swamp Gum," or "Cider Gum."

This tree also bears the name of the "Sugar Gum" because of the sweetness of the leaves, which consequently are browsed upon by stock. It is a common tree in Tasmania, where it is called "Cider Gum," as a so-called cider is made from the sap taken from it in the springtime.

Tasmania, the extreme south-eastern portion of South Australia, thence to Gippsland, and into New South Wales as far as Mount Victoria and Hill Top.

ONAGREÆ.

Jussieua repens, Linn.

Eaten by cattle at Mudgee. (Hamilton, *Proc. Linn. Soc. N.S.W.* [2], ii., 276.) This is an aquatic, or semi-aquatic, plant.

Found in all the colonies except Tasmania and Western Australia.

FICOIDEÆ.

Trianthema crystallina, Vahl.

This is a creeping succulent annual from 1 to 3 feet long. It forms an excellent fodder plant. This Natural Order includes "Pig's Faces" (*Mesembryanthemum*), New Zealand "Spinach" (*Tetragonia*) and other useful fodder plants.

This plant is not endemic in Australia.

Found in the interior of all the colonies except Victoria and Tasmania.

UMBELLIFERÆ.

Daucus brachiatus, Sieb.

"Native Carrot."

Stock are very fond of this plant when it is young. Sheep thrive wonderfully on it where it is plentiful. It is a small annual herbaceous plant, growing plentifully on sandhills and rich soil. The seeds, termed "Carrot Burrs," are very injurious to wool, the hooked spines with which the seeds are armed attaching themselves to the fleece, rendering portions of it quite stiff and rigid. The root is astringent, but much relished by sheep. It grows in immense quantities on the rich black flats of flood deposit. To watch a flock of sheep feeding on carrot ground, where there is not a vestige of anything green, would astonish a stranger. A sheep will smell out a root and scrape

away with its hoof until it can grasp the top with its teeth, when it draws it out. The common carrot belongs, of course, to this genus, and the fact that it is descended from an apparently worthless, weedy plant, indicates that the present species is capable of much improvement by cultivation. This plant is not endemic in Australia.

All the colonies.

BORAGINEÆ.

Trichodesma zeylanicum, R.Br. (Syn. *Pollichia zeylanica*, F. v. M.).

Baron Mueller recommends this plant as a fodder herb, stating that the dromedaries of Giles's exploring party (1873-4) were found to be particularly partial to it. It is not endemic in Australia.

All the colonies except Victoria and Tasmania.

CONVOLVULACEÆ.

Convolvulus erubescens, Sims.

"Pink Convolvulus."

Esteemed a good fodder plant in places in the Western districts.

Found in all the colonies.

Ipomœa pes capræ, Roth.

Mr. Nicholas Holtze, of the Botanic Gardens, Port Darwin, informs me that this plant is used as pig-feed by the Chinese of the Northern Territory.

Found in Western Australia, New South Wales, and Queensland.

SOLANEÆ.

Solanum simile, F.v.M.

Called "Quena" by aborigines in South Australia.

Sheep feed on this plant. (Annie F. Richards in *Proc. R.S., S.A.*, iv, 136.)

All the colonies except Tasmania and Queensland.

MYOPORINEÆ.

Myoporum platycarpum, R.Br.

"Dogwood," "Sandalwood."

The leaves are eaten by stock, but not, as far as I can learn, with any evil effects. It is often felled for sheep in time of drought.

All the colonies except Victoria and Queensland.

Eremophila longifolia, F.v.M.

"Emu Bush," "Dogwood;" "Berrigan" of the natives.

The leaves are greedily eaten by cattle and sheep. Observations in regard to the effect on stock of browsing upon plants belonging to the *Myoporineæ* are much needed, as statements hitherto made in respect to them are not always reconcilable. Some of the plants of this natural order are, in fact, reputed to be poisonous.

Allied to this plan is the "Sandalwood" or "Budtha" (*Eremophila Mitchelli*), the bark of which is very appetising to rabbits. Consequently they make for this shrub as soon as grass fails, and hence twigs of the "Budtha" are used (when treated with strychnine) as bait for rabbits.

All the colonies except Tasmania.

Eremophila polyclada, F.v.M.

"Lignum..

Useful fodder-bushes. This and *Muhlenbeckia Cunninghamii* often grow together and go under the same name. (T. L. Bancroft.)

Found in all the colonies except Tasmania and Western Australia.

VERBENACEÆ.

Avicennia officinalis, Linn.

A "Mangrove" or "White Mangrove." The "Tchoonchee" of some Queensland aborigines, and the "Tagon-tagon" of those of Rockhampton (Queensland), and the "Egaie" of those of Cleveland Bay.

The leaves of this tree are eaten by cattle and are considered very nutritious. At one homestead (Port Curtis, Queensland) I noticed that the cows ran up and collected every time that an axe was used, in the expectation of a few limbs of this mangrove being lopped off for their consumption. (Hedley, *Proc. R.S. Qd.*, v.)

The same thing is apparent in New South Wales. The mangroves are cut down by the teamsters for their cattle, and in many parts of the coast the cattle have done much harm to oyster beds through trampling them down in their efforts to reach the mangroves. The mangroves protect the banks of tidal rivers, &c., and are, in consequence, exempt from the operation of wood-cutters' licenses.

Found around the greater part of the Australian coast.

PLANTAGINEÆ.

Plantago varia, R.Br.

"Native Plantain."

This plant is relished by stock. Speaking of an allied species (*P. lanceolata*), an English writer observes :—"Its mucilaginous leaves are relished by sheep, and, to a certain extent, by horses and cattle, but it seldom answers as a crop, unless on very poor land where little else will grow. It was generally sown with clover, and this mixed crop is occasionally seen now on barren soils, but there can be little doubt that the plantain is inferior in produce, and probably in nutritive qualities, to many plants that would grow equally well on the same land. Mingled with grasses in permanent pasture it may be beneficial in small quantity, but tends, like all broad-leaved plants, to destroy the more delicate herbage around it."

All the colonies.

POLYGONÆ.

Muhlenbeckia Cunninghamii, F.v.M.

"Lignum."

By some considered a useful fodder bush. (T. L. Bancroft).

Found in all the colonies except Tasmania.

AMARANTACEÆ.

Ptilotus obovatus, F.v.M.

"Silky Heads."

This plant grows on rough stony country, and is relished by all stock in the neighbourhood of Broken Hill and other places. On the barren rocks it is frequently the principal food for stock. The same remark applies more or less to other species of this genus, which is scattered through much of the western country.

Found in the interior of all the colonies except Tasmania.

NYCTAGINEÆ.

Boerhaavia diffusa, Linn.

Called "Goitcho" by the natives of the Cloncurry River, Northern Queensland.

The Rev. Dr. Woolls points this out as a useful forage plant, which, having a long tap root, can withstand a considerable amount of drought, whilst it affords a pasture early in the season, ere the grasses are fully developed. A Parkes resident states that stock are particularly fond of this plant; they seem to prefer it to all other kinds of feed available to them. This plant is not endemic in Australia, and is a troublesome weed in some warm countries.

Mr. N. Holtze informs me that it is used for pig-feed by the Chinese of the Northern Territory.

In all the colonies except Tasmania.

PROTEACEÆ.

Conospermum stœchadis, Endl.

Western Australia and New South Wales.

C. triplinervium, R.Br.

Baron Mueller suggests that these plants be tried on the worst desert country, as all kinds of pasture animals browse with avidity on the long, tender, and downy flower-stalks and spikes, without touching the foliage, thus not destroying the plant by close cropping.

Western Australia.

Hakea leucoptera, R.Br.

"Pin or Needle Bush" or "Ury."

Eaten by stock.

Found in all the colonies except Tasmania and Western Australia.

EUPHORBIACEÆ.

Adriana tomentosa, Gaud.

Eaten by cattle and horses. (Hamilton, *Proc. Linn. Soc., N.S.W.* [2] ii., 269).

Found in all the colonies except Tasmania.

Baloghia lucida, Endl.

"Brush Bloodwood."

At Mount Dromedary this species has the reputation of being greedily eaten by cattle. A farmer cut the limbs of this tree down for his cattle, and they would always eat the leaves of it before anything else that was given to them.

Coastal New South Wales and Queensland.

Bertya Cunninghamii, Planch.

The "Gooma" of Western New South Wales. (Miss M. A. Clements).

A fodder shrub which has no chance of making headway where sheep feed. In spite of the reputedly poisonous natural order to which it belongs, there is no record of it having proved deleterious to animals. It has a pleasant bitter flavour.

Found in the drier parts of Victoria and New South Wales.

SANTALACEÆ.

Choretrum Candollei, F.v.M.

Sent as an edible shrub from Grenfell.
New South Wales and Queensland.

Fusanus acuminatus, R. Br.

"Quandong."

A useful fodder-bush, protected from the operation of timber licences. See *Sterculia diversifolia* (Kurrajong).
Found in the interior of all the colonies except Tasmania.

URTICEÆ.

Ficus glomerata, Willd.

"Clustered Fig."

The leaves are used in India for cattle and elephant fodder. (Gamble, *Manual of Indian Timbers.*)
Queensland and Northern Australia.

Ficus macrophylla, Desf.

"Moreton Bay Fig."

This is an excellent fodder plant, cattle and horses eating the leaves, young twigs, and figs with great zest. For further particulars, see *Agricultural Gazette*, 1893, p. 609, and 1894, p. 206.

The Small-leaved Fig (*F. rubiginosa*, Desf.), appears to be of equal value as a foddér plant, and doubtless other of our native figs may be put to similar uses. I have known cows fed all the year round on the leaves and figs which dropped from these trees.

CASUARINEÆ.

Casuarina glauca, Sieb.

I have seen cattle leaving fair grass for branches of this plant, and probably they will feed on the leaves of all *Casuarinas*.
Found in all the colonies except Tasmania and Western Australia.

Casuarina stricta, Ait. (Syn. *C. quadrivalvis*, Labill.)

"She Oak," "Wargnal" of the aborigines.

This is a useful fodder tree in Victoria and Southern New South Wales. Mr. S. Dixon states that in Port Lincoln (S.A.) the fallen catkins (male inflorescence) form the chief sustenance in winter on much of the overstocked country. He adds that this tree is too sour to be very useful to ewes rearing lambs; but if sheep had only enough of it, the "brake" or tenderness of fibre would often be prevented in our fine-wool districts, and much money saved by the increased value a sound staple always commands.
The foliage is eagerly browsed upon by stock, and in cases of drought these trees are pollarded for the cattle. Old bullock-drivers say that cattle prefer the foliage of the female plant. (J. E. Brown). *Casuarina* foliage has a pleasant acidulous taste, but it contains a very large proportion of ligneous matter.
All the colonies except Queensland and Western Australia

Casuarina suberosa, Otto et Dietr.

"Erect She-oak," "River Black-oak," "Dahl-wak" of the aboriginies.

A very valuable fodder tree, largely used and much valued in the interior districts as food for stock during periods of drought. The same remarks apply more or less to all species of *Casuarina*.

All the colonies except Southern and Western Australia.

BALANOPHOREÆ.

Balanophora fungosa, Forst.

This root parasite was noticed to be very abundant in all the scrubs, producing unusually large heads, some noticed being over 3 in. in diameter, and varying from nearly white to dark reddish-brown. Mr. Banning, of Freshwater Creek, says that bullocks are so eager to obtain a bite of it that it is often difficult to drive them through a scrub where it abounds.

(F. M. Bailey, in *Rep. Bellenden Ker Exped.*, 1889.)

Queensland.

LILIACEÆ.

Flagellaria indica, Linn.

A "Lawyer Vine."

Leichhardt (*Overland journey to Port Essington*), p. 424, speaks of his bullocks feeding heartily upon this plant, particularly as the country was most wretched and the grass scanty and hard. This plant is not endemic in Australia.

New South Wales, Queensland, and North Australia.

PALMEÆ.

Livistona Leichhardtii, F.v.M.

Mr. Nicholas Holtze informs me that the leaves are eaten by horses in the Northern Territory.

Found in Northern Australia.

LYCOPODIACEÆ.

Psilotum triquetrum, Swartz.

Locally known as "Fern" (Kempsey). Grows on bird's nest and other ferns. Cattle are fond of it.

Victoria, New South Wales, and Queensland.

MARSILIACEÆ.

Marsilea quadrifolia, Linn.

"Nardoo," "Clover Fern."

This plant is much relished by stock. It grows plentifully in swamps and shallow pools of water. It is, however, better known as yielding an unsatisfactory human food in its spore-cases.

All the colonies except Tasmania.

Botanical Notes.

The Water Hyacinth or *Pontederia* (*Eichhornea*) *crassipes*) as a possible Pest.

This is a plant known to botanists as *Eichhornea or Pontederia crassipes*, and commonly as "Water Hyacinth." It is a pretty aquatic, with pale purplish flowers, and it is cultivated in tubs and ponds in the warmer parts of the colony.

For a year or two we have received scrappy bits of news in the newspapers and scientific journals referring to the fact that in certain waters flowing into the Gulf of Mexico the plant had so multiplied that it had actually become a hindrance to navigation. Recently there has come to hand *Bulletin* No 18 of the United States Department of Agriculture (Division of Botany), which is a pamphlet by Herbert J. Webber on the Water Hyacinth and its relation to navigation in Florida.

Following are extracts from the pamphlet referring to the spread of the plant :—

Introduction and spread of the Water Hyacinth in Florida.

As nearly as can be learned, however, it was first introduced into the St. John's River about 1890, at Edgewater, about 4 miles above Palatka. At this place it had been grown for some time in a pond, and when it was desired to clear the place out the plants were thrown into the river. Here they grew luxuriantly, producing beautiful masses of flowers, which rendered the river attractive. At this time no one had any idea the plant would become a nuisance, and it was carried by settlers up and down and introduced at different points to beautify the river in front of settlements. It was also distributed by boats passing up and down, and it soon became abundant up as far as Lake Munroe and down as far as the increasing brackishness of the water allowed its growth. In 1894 the water hyacinth had become so abundant that it began to attract the attention of steamboat men and fishermen, although at that time the amount was not sufficient to cause trouble. After the severe storms of October, 1894, which carried the plants out of the bayous and creeks, they were noticed to be very abundant.

In October, 1894, some plants were carried up the Ocklawaha River, the main tributary of the St. John's, and placed in a pool at Howard's Landing, 14 miles down the river from Silver Springs. This became the seed-bed for the entire lower and navigable portions of the Ocklawaha River. The plants multiplied rapidly and were crowded out into the river. The current carried them down stream, and they have spread along the entire lower portion of the river.

Damage caused by the Water Hyacinth.

That the water hyacinth is becoming a serious menace to navigation in the St. John's River is unquestionably true. Small boats with screw propellers find it impossible to penetrate a very large mass of the plants, as they lack the necessary power, and the plants soon become entangled in the screw and prevent it from revolving. Parting the plant with boat-hooks, &c., is very slow and tedious. Paddle-wheel steamers are able to penetrate the extensive masses of the plants much better, but are generally hindered and frequently entirely blocked. When a large steamer, going at full speed, strikes a bank of the hyacinths, it comes almost to a standstill. In side-wheel steamers the plants collect between the wheel and bulkheads, packing in so solidly that it is often almost impossible to reverse the engine. This necessitates caution in approaching the landings.

Steamers with low-pressure engines are troubled by the clogging of the injection pipes, so that sufficient water cannot be secured for the condensers. In the case of some boats the obstruction is occasionally removed by blowing steam through the injection pipe. This process, however, is rather dangerous, as the injection pipes and condensers are not constructed with a view to having heavy pressure applied from within. Floating logs frequently lie concealed in the masses of the plants and form a serious danger to navigation. Several boats have already been injured to some extent by striking such obstructions.

Mr. Webber's pamphlet also takes cognizance of the effect of the spread of this plant on the timber and fishing industries, and also on bridges, through the accumulation of the plants. Then it has been reported to be deleterious to health, owing to the accumulation of large masses of vegetable matter. Finally, methods of extermination of the plant are considered, mechanical devices being most favoured; but for details of these I must refer to the pamphlet.

In the Botanic Gardens at Sydney, visitors must have noticed the great spread of the water hyacinth during the past year. I had the silt removed from all the ponds, except the one nearest the sea-wall, and the water hyacinths were taken out with the rest of the material. Apparently there was no water hyacinth left, but as the warm weather came a few plants made their appearance, and these spread with such rapidity that by the autumn the greater part of the surface of the pond, second only to the largest in size, was covered with this plant. When the winter rains set in these plants were piled up against the rustic bridge to such an extent that, had they not been removed, the bridge must have been carried away. The pond has not yet been entirely cleared of water-hyacinth, and it will probably be a costly work to carry out. The Sydney district is hardly warm enough for this plant to attain its full development; but I have seen enough of it in Sydney to cause me to issue a warning that it may become a pest in sluggish waters in the Northern districts, say from the Macleay northwards. It is, therefore, hoped that persons who cultivate this pretty plant will keep it well under control, for if it be allowed full scope it may become, within certain areas, as great a pest as *Lantana*, or prickly pear.

Since the above was written, I notice that Mr. William Soutter, of the Acclimatisation Society's Gardens, Brisbane, issues a warning in the September issue of the *Queensland Agricultural Journal* in regard to the Water Hyacinth. Mr. Soutter's warning is more necessary in Queensland than in New South Wales; but, without being an alarmist, I think the Water Hyacinth may very readily become a serious pest on the northern rivers. And, talking of weed pests, do not let our northern river friends turn a blind eye to the Cockle Burr, in regard to which I issued an emphatic warning in the *Gazette* for July of last year.

The Alleged Poisonous Nature of Sorghum.

[Previous reference 1897 (July), p. 451.]

Veterinary Captain Henry T. Pease, Principal, Lahore Veterinary College, has published the following "Note on Jowár Poisoning," which to some extent supplements the note given in our July issue. I may again remind readers that Jowár is the Indian name for *Andropogon sorghum*, of which *Sorghum vulgare* is a synonym :—

When *jowár* becomes dried up from deficiency of rain, it becomes poisonous to cattle. The common idea amongst the people is that this is caused by a worm named *bhaunri*, which infects the *jowár* plant at this time. It is a well-known fact that if rain

falls on *jowár* which has thus become poisonous, the insect is said to perish, and unless the ears have appeared before the rain failed, the crop often recovers itself and yields a good outturn of grain. There is another reason why *jowár* becomes poisonous to cattle in these circumstances, and this is, that a salt becomes formed in it in great quantities, and this salt is nitrate of potash. When this salt is deposited in the plant, owing to failure of the rain, cattle eating it are rapidly poisoned. If rain falls on the crop thus altered it loses its poisonous properties. In order to avoid poisoning cattle, therefore, and to utilise *jowár* which has thus become altered and poisonous, all that appears necessary is to kill the insect or remove the salt; and it seems that this is done naturally when rain falls on it. If we have *jowár* in the poisonous condition, therefore, we can most probably render it harmless by cutting it up and washing it in water, and thus be able to utilise it as fodder.

This is evidently not the case here. Last summer the cattle at Wagga Farm were fed on dried-up mature sorghum without the slightest ill effects.

Alleged Poisonous Nature of White Cedar Berries.

(Previous Reference, 1897 (Feb.), p. 827.)

Following are two apparently well authenticated instances of the death of pigs through eating white cedar berries (*Melia azedarach*, otherwise, *M. composita*). As the tree is so extensively planted in this colony, it behoves owners to see that pigs at least are not allowed to gorge themselves with the berries. It is not expected that a few, eaten with other food, will occasion serious harm.

Of the first case I received information from a valued correspondent at Walcha (Mr. A. R. Crawford). He wrote:—"I enclose a note from Mr. Edward Fitzgerald, of East Cunderang, who has had trouble with his pigs: 'We have had one fat baconer die. Last night a beautiful sow died after three days' sickness. I have just held a *post-mortem* examination, and find she died from inflammation of the stomach, which contained a lot of white cedar berries. Another pig died this morning.' At the season when the berries were plentiful, a splendid sow died the same last year, but only one. One sow was sick last week, and is now better; she ate nothing for two days; she is still weak, but eats eagerly."

Mr. Crawford being about to visit Cunderang, he kindly obtained further details in regard to the poisoning of the pigs, at my request. Following is his further report:—

"The most striking symptom they showed was that they could lie in no other position than on their bellies. If they lay on their sides, or attempted to do so, they screamed with pain and rose on to their bellies at once. The least movement gave them pain. They would not eat, or even drink milk, for days before death.

"The *post-mortem* examination disclosed a much inflamed inner lining of the stomach, and very much thickened. One young breeding sow refused food for two days, but ultimately recovered, though she became very poor after it.

"As a remedy I burnt a lot of timber and made fresh charcoal for them to eat, and I fancy it had a beneficial effect. They ate it eagerly.

"There was no chance for them to get a poisoned bait, unless a stranger laid one, which is not probable. The old sow lived five days after refusing food."

The second case was reported in the daily papers during the month of August, when Mr. James Durrant, of Druewalla, Jamberoo, lost eight pigs through eating white cedar berries. A large quantity of these berries was found in the paunch of each animal.

Perhaps the matter may be considered of sufficient importance to engage the attention of the Stock Department, if the evidence I have got together is not considered sufficiently conclusive.

Mr. S. Pegum, of Camperdown Farm, Brownlow Hill, Camden, writing on this subject, says :—

"Three small pigs ate some white cedar berries. They soon after became very ill, unable to stand or move, heart beating feebly, with occasional spasmodic shudderings, apparently in a forward direction, limbs cold, eyes well open but not fixed or staring. Being of opinion that they were poisoned by the prussic acid contained in the kernels of the berries, for experiment I took one of the pigs who seemed at the time *in extremis* (couldn't raise a squeak even), and treated him accordingly, viz., put him at once into a warm bath, and as soon as it could be got ready, gave the *whites* of two eggs beaten up and a full teaspoon of baking soda in some warm milk and ginger. Then put him into a sugar bag with a warm brick and left him for the night well covered up, nice and snug, in a warm place. All this time, if he was not "as dead as Julius Caesar," he was quite as unable to stand or move, being quite passive to all the treatment, which did not take many minutes, neither squeaking nor kicking. I do not know how long it took him to get well, but in the morning he was quite recovered, and what with the bath, &c., he looked none the worse for the trouble, being able to run about and eat as usual. The other two pigs died. Examination showed that they had eaten about a small pannikinful of the berries, which were crunched and scarcely at all digested. I herewith forward some for analysis."

The sample of berries referred to was brought under the notice of the chemist, Mr. F. B. Guthrie, who reports that they do not contain prussic acid. and he has so far been unable to identify any poisonous property.

Tuberculosis and Tuberculin.

(Reprinted from Report of Dairy Conference.)

By Mr. E. STANLEY.
Government Veterinarian.

History, Cause, and Distribution of the Disease.

ONE-SEVENTH of all deaths in the human family are due to this disease, and it very frequently is found in many of the domesticated animals all over the world.

Although the disease had been known for centuries, it was not until 1810 that tubercular nodules were proved to be peculiar to this one disease; and not until 1865 was it declared to be infectious by Cohnhelm. He, after repeated inoculation experiments, emphatically declared that it was a specific infectious disease. The cause of the tubercles was discovered by R. Koch, of Berlin, in 1882, to be a peculiar bacillus of a special shape: this fact has proved extremely deep and lasting. The incomparable certainty and positiveness of his investigations are admired by everybody.

To quote his own words: "We can with good reason say that the tubercle bacillus is not simply one cause of tuberculosis, but its sole cause, and that without tubercle bacilli you would have no tuberculosis. In those processes where you find tubercle bacilli, there is true tuberculosis," no matter what the pathological picture is, or what the clinical evidence may show in single cases. The bacilli are very slender, medium-sized rods, somewhat smaller than a red blood corpuscle, and incapable of voluntary motion.

They are capable of resisting destructive influences to an unusual degree; sputum thick in albuminous matter protect them; they withstand drying for months, a temperature near boiling point, the action of the gastric juices and also the influences of the strongest decomposition, without the least curtailment of their infectious activity. After many failures, and with much perseverance, Koch has succeeded in artificially cultivating the bacillus with coagulated blood serum, and subsequently inoculating his cultures into various animals always produced the disease tuberculosis. No matter whether the virus was injected into the abdomen, or into a vein, or into the eye, or rubbed on to a sore on the skin, or by inhalation, the results were always the same: he evoked tuberculosis in every way. Other investigators as well as Koch have found that by our food containing tuberculous material the disease can be produced, and it is no longer doubted that the bacilli are capable of entering the body in all possible ways.

Development of the Disease.

The disease develops in the first place in the immediate neighbourhood of the spot where the bacilli find entrance, the affection being in the beginning merely local, and may possible remain so, owing to the presence of leucocytes,

or police cells in the body, that swarm around the bacilli and destroy, or at least isolate them, and imprison the affected part; but the enemy often proves too powerful, and getting away into the blood current, the poison is distributed and the whole body is inundated with the bacteria, and general tuberculosis is the result.

Tubercles are, therefore, met with in any and every part of the body, especially in the lymphatic glands, as they are especially concerned with the leucocytes in attempting to arrest their spread.

The disease in guinea-pigs sets up necrosis, without actual cheesy degeneration in the liver and spleen; in monkeys the tubercle formation is thin, liquid, and purulent; in cattle, consolidated and cheesy deposits; in poultry, compact tumor masses with imbedded lime.

Histologically they are all the same, and the distinguishing criterion is the presence of the bacilli.

The bacilli perish as the tubercular processes advance, as the blood supply is obliterated; therefore, being less numerous, they are more difficult to demonstrate.

Investigators have shown that milk from tubercular cows is a very important matter, as bacilli are found in the milk of nearly half the tubercled cows, even when there is no perceptible disease in the mammary glands. The micro-organisms resist the gastric juices and attack first the intestines, then the spleen and liver in succession.

The lungs in both man and in animals are often primarily affected; this points to the fact of inhalation of the bacteria as dry dust. Myriads, however, perish by desiccation and the sun's rays.

Cattle often become affected by licking themselves or each other, and the disease is often found in the throat glands. The cow-bails and feed-boxes harbour the disease, so that rigid sanitary precautions in dairies cannot be too strictly enforced.

A tuberculous cow is a hot-bed of infection, and a constant, and always present, source of spreading this terrible disease.

As this disease may exist in an animal without its presence being suspected, it is very important to know that a means exists for detecting it, even in its very earliest stages. This method is the outcome of Koch's labours, and consists in the use of

Tuberculin.*

This fluid is a laboratory preparation made by the artificial cultivation of the bacilli, and extracting their toxic properties by means of glycerine, filtered through porcelain.

This gives a clear virus, perfectly free from bacilli; so there is not the remotest chance of its conveying the disease.

The effect of a few drops of this virus on a cow having invisible—that is, latent or active—tubercle disease, is to cause within a few hours a very remarkable rise of bodily temperature, which is only transient, and soon disappears, leaving the animal unaffected by its application, but the owner has the very valuable information of knowing which of his herd are tubercled.

Healthy cattle remain quite unaffected by the injection of any quantity of tuberculin in any way whatever. Stock-owners are, therefore, strongly urged to use this test on their herds, as the time will come when only tested cows will supply milk for human food.

* *Vide* a paper on tuberculosis in cattle, *Agricultural Gazette*, 1896.

Effects of Tuberculin.

In answer to a question as to whether it was possible, when the tuberculin was injected into an animal and it showed no signs of tuberculosis, it might still have the disease, Mr. STANLEY said it was possible; but the disease would be quiescent or chronic, and the animal apparently recovering.

Mr. DYMOCK: Were cattle reared on limestone country freer from tuberculosis than cattle reared upon country that had no lime in it?

Mr. STANLEY: The nature of the country makes no practical difference.

A REPRESENTATIVE: Was it not a fact that there might be localities in a district which were, it might be said, incubators of tuberculosis?

Mr. STANLEY: The explanation is that there has been tuberculous cattle there, and they have spread the disease and the locality has become infected; but even if the locality were clear of tuberculous beasts, there is no reason why it should not be infected.

Mr. ARMSTRONG: A beast to be slaughtered may be thoroughly healthy-looking, and yet, after being slaughtered, it is found to have tuberculosis. How do you account for that?

Mr. STANLEY: The explanation is that the disease develops very slowly, and the animal gets fat while the disease goes on.

A REPRESENTATIVE: Would sterilising completely destroy tuberculous spores in milk?

Mr. STANLEY said that was a scientific question that he was not prepared to answer, as spores had not been demonstrated in tubercle bacilli.

A REPRESENTATIVE: Might you not, by testing the animals with tuberculin, render them dangerously susceptible to take the disease?

Mr. STANLEY. There is not the slightest danger, because the tuberculin passes out of them in forty-eight hours.

A REPRESENTATIVE: How was it, if the bacilli were found in underdone meat, that there was not a greater number of human beings affected?

Mr. STANLEY: The disease was not found in well-cooked meat. He had said it was found experimentally in gravy or meat-juice.

"Coast Cough."

In reply to a question as to whether the "coast cough" disease was tuberculosis, Mr. STANLEY said: Yes; the "coast cough" is a distinct indication of tuberculosis. It has been so demonstrated by many *post-mortems*, and also by microscopic examinations finding the bacilli.

Effects of Sterilising Milk.

Would sterilising destroy all the microbes in milk? Most scientists said that sterilising would destroy all the bacilli; but others had not so much confidence in it. Unfortunately the matter had not yet been definitely settled. Sterilising was like cooking meat; it must be complete to be successful.

Was there any danger in connection with the tuberculin test of infecting the healthy animals treated? No; if an animal were healthy, the tuberculin would have no effect in any way whatever.

First Discovery in South Coast Herds.

In reply to a question as to how long ago it was since tuberculosis was discovered in the South Coast district, Mr. STANLEY said that more than ten years ago he had pointed out the prevalence of the disease there.

A REPRESENTATIVE remarked that to his knowledge the "coast cough" had been there twenty-five years ago.

Mr. STANLEY: It had usually been called cancer and lumpy throat disease. The disease vulgarly called "lumpy jaw" was now known to be actinomycosis, and it had also existed there. Tuberculosis was no new thing, but it was only of recent years that the importance of it had been brought under notice. Tuberculosis and actinomycosis would probably be regarded as the same disease by untrained men. But for the former there was no curative remedy, while the latter could be successfully treated. There was no doubt that actinomycosis resembled tuberculosis. It was caused by a micro-organism which finds access to the animal's gums, and thence into the teeth sockets, and grows inside the jaw bones. It would sometimes find its way into the various organs of the affected beast. He had found actinomycoces in a cow's udder—proved by the microscope, although so closely resembling tuberculosis to the naked eye.

Have the whole Herd Tested.

Mr. STANLEY said that his advice to everyone was: have the whole herd tested; keep watch on the animals found to be infected. If a very good cow were affected, with certain precautions one might breed from her; but if an ordinary cow proved to be diseased, destroy her at once; it was by far the best policy.

A REPRESENTATIVE asked, in view of the fact that Mr. Stanley regarded "coast cough" as tuberculosis, how he accounted for the fact that animals suffering from the cough when removed inland recovered?

Mr. STANLEY could not believe it. Had any of the seemingly recovered cattle been killed and examined? Unless that had been done, how was one to know whether they were tuberculous or not. The cattle referred to might possibly have been exposed on wet, swampy ground, and have caught cold. It was quite common for cows to have bronchitis and affections of that temporary nature and recover. He maintained that the disease called "coast cough" was tuberculosis, and must be considered incurable.

Breeding from a Tested Bull.

For what period was it safe to breed from a bull after he had been tested? He would recommend that stud bulls be tested every six months.

Tuberculous Beef.

Had it been successfully proved that the disease could be transmitted to human beings by the use of tuberculous beef? He believed it had been. The disease was communicable to other animals, and the inference was that it was also communicable to human beings by that means.

Tuberculosis and Horses.

Was it possible for tuberculosis to be transmitted from horses to horned cattle? There was no doubt that was possible, but very few horses have tuberculosis.

Cancer and Tuberculosis.

Was it possible for cancer to be mistaken for tuberculosis? That depended upon the situation of the enlargement. The cancerous swelling might be as large as an orange and then it might be mistaken for a tubercular enlargement. It was possible, but very improbable, that the diseases would be confused by anyone practically familiar with them.

Moving Lumps.

Were moving lumps that could sometimes be felt inside the skin tuberculosis? Most frequently, but there were sometimes lumps in the brisket that were not tuberculosis, also warty growths and dermoid cysts occur, closely resembling the tubercular tumors.

Did he know why cows subject to "coast cough" were fond of chewing bones of dead cattle? The fondness for chewing bones had nothing to do with tuberculosis. It simply showed that the animals had a morbid appetite from lack of mineral constituents in their food and water. They wanted lime.

Inoculation for Pleuro-pneumonia and Tuberculosis.

Did he think inoculation for pleuro-pneumonia a cause of the spread of tuberculosis? Not if it were properly performed and proper virus were used. There had been many a case in which disease had been transmitted through the injection of impure virus, *i.e.*, virus taken from a tubercular animal that happened to have pleuro-pneumonia. That showed that there was a real danger in inoculating animals for pleuro-pneumonia, unless you could make sure that the animal was free from other disease than pleuro. In Queensland they would not use virus which had not been issued through the Government laboratory, in order to obtain it pure.

Notes on some Chemical Points in the Preparation of Insecticides and Fungicides.

F. B. GUTHRIE.

In the mixing and using of chemicals for spraying purposes there are a number of chemical points involved which are commonly passed over in the directions issued. As such mixtures are chemical compounds, these points play a very important part in their preparation and use; and I think it will be of advantage to discuss some of the more common mixtures purely from the point of view of the chemist.

(a) Bordeaux Mixture.

The proportions recommended by the Department for this mixture are as follows:—

Copper sulphate	... ...	6 lb.
Lime	... ...	4 lb.

made up with 22 or 40 gallons water, according to the season.

These are the proportions given both in the "Farmers' and Fruitgrowers' Guide" and in the "Insect Pest Chart."

Copper Solution.

In the "Guide" the bluestone is dissolved in cold water; in the "Chart" hot water is recommended. It is, of course, immaterial which is used. If the mixture is to be made in a hurry it is best to boil the copper sulphate in water. If there is plenty of time use cold water; but in this case the bluestone must be suspended in a porous bag (bit of muslin or sacking) as near the surface of the water as possible. If the copper salt is thrown into the vessel, and water poured on the top of it, it will not dissolve in a week. When suspended as described it should dissolve in about twenty-four hours.

The sulphate of copper solution when made must be diluted largely before the lime solution is added to it. This important point is omitted in the "Chart." If the copper solution is too strong, the precipitate formed is thick and heavy, and liable to clog the nozzle of the spray-pump. If the copper solution is made as directed in the "Chart," by dissolving in 4 gallons hot water, it should be diluted to 20 gallons.

Lime.

The lime, which should be freshly burnt, is slacked with a small quantity of water. I would recommend slacking on a board rather than in a cask, because if the lime is really freshly burnt there will be considerable heat evolved, and the barrel may suffer. Place the whole of the lime on a board, and pour over it about 3 or 4 pints water. The lime, if it is good, should become

very hot, crack asunder, give off a quantity of steam, and finally crumble into a fine, white powder. This is now emptied into a barrel and water added. It is not an easy matter to make the whole of the lime into a wash. It cannot be done by simply stirring about with a stick. The best way is to use a shallow tub, so that the lime may be pounded up with the water, all the lumps being broken up. Allow to settle, and pour off the milky solution through a strainer if any lumps are present (into the copper sulphate if you like, or into another barrel), and add more water, repeating the pounding until all the lumps have disappeared.

Mixing.

The mixture must be made by pouring the lime-water into the copper solution, and not by adding the copper solution to the lime-water.

The Proportions of the Ingredients.

The proportions above given provide ample lime to more than neutralise all the copper sulphate; in fact, there is more than twice the quantity required to convert the copper into the hydrate, provided, firstly, that the lime is pure; secondly, that it is freshly burnt; and thirdly, that the lime is really all made into wash.

With regard to the latter point, I have never seen any instructions given, and I suspect that in many cases not more than quarter or half the quantity of lime recommended becomes finally combined with the copper.

If, in addition to this, the lime is not pure, and has been burnt some time before being used, it may quite easily happen that instead of the above quantities of lime being in excess of what is required, it may be altogether insufficient for the purpose, and that the solution may contain free copper sulphate. I assume that free copper sulphate even in small quantities does "burn" the foliage, and that it is undesirable to have any in the mixture. On this account, it appears to me that it is preferable to have no fixed quantity of lime, but simply to have a definite quantity of copper, and to add the lime until the copper is neutralised. This is the plan recommended in the latest Bulletins of the United States Department, and is described in detail by Dr. Cobb in the April number of the *Gazette.*

In order to know when the copper sulphate is destroyed, the readiest test is ferrocyanide of potassium; but it is important to remember that at a certain point ferrocyanide ceases to give the characteristic colouration (in such a solution as we are dealing with), although there is still unaltered copper sulphate in solution. In other words, the solution may contain free sulphate of copper, although the ferrocyanide test, applied as directed, does not show it. Therefore it is important to remember that the mixture is not ready for use when ferrocyanide no longer gives a red colour, but that a quantity more lime (Dr. Cobb recommends as much again) must be added.

Vessels Employed.

For the copper solution wooden vessels are preferable, though copper vessels may be used. Iron vessels should be avoided. For the lime, wooden tubs or barrels. Do not leave the mixture in the spray-pump, as it will slowly attack the copper; but when the spraying is finished, pour it away and wash the pump and hose well with water.

Purity of Ingredients.

A sample of "bluestone" was received some time ago which contained a quantity of sulphate of iron. This adulteration could only have been effected by dissolving copper sulphate and sulphate of iron, mixing the solutions, and

allowing them to crystallise out. Such a method is much too elaborate to be carried out on a small scale, and there must be more of the stuff about. The following hints will enable anyone to suspect such a compound. Bluestone should be in the form of dark-blue crystals, (the adulterated mixture referred to is light-blue, like sulphate of iron). They dissolve completely in water—readily and completely in hot water or water to which any acid is added.

In order to test its purity still further add ammonia. A pale-blue precipitate is formed, which dissolves to an intense blue colour. This solution should be perfectly clear, and leave no sediment on standing. If a reddish sediment settles, it is due to the presence of iron.

Lime.

The best freshly-burnt stone-lime only should be used. To test it, place a few lumps in a small heap and sprinkle with water. The water should be absorbed by the lime, which gradually falls to pieces, becoming very hot in the process, and giving off a quantity of steam. It gradually crumbles to a fine, white powder. If it does not get hot enough to give off steam, it has not been freshly burnt.

(b) Lime, Salt, and Sulphur Wash.

The only difficulty that is likely to be experienced in making up this mixture is in getting the sulphur thoroughly incorporated. To do this requires continuous boiling, with constant stirring, until the liquid is of a deep yellow colour. If it is feasible, the sulphur should be first ground up with a small quantity of water into a paste in the same way that mustard is made, so that the grains of sulphur may be thoroughly wetted. This will greatly hasten the process, and if as much as 20 lb. sulphur are taken, this may be ground up a little at a time in a largish mortar and added to the boiling solution.

The best vessel to use for boiling this mixture is an enamelled vessel. If only a small quantity is made at a time an ordinary enamelled preserving pan is the very best kind of vessel. If a larger quantity, a number of such preserving-pans. In the absence of these, an iron vessel or an ordinary oil-drum may be used. On no account use copper vessels.

The actual manner in which the ingredients are added does not matter. I would recommend slacking the lime on a board, as with the Bordeaux mixture, in preference to slacking it in the vessels. Hot water is not necessary for slacking it.

The main point is that the lime and sulphur should be well mixed and thoroughly boiled together.

(c) Kerosene Emulsion.

The main trouble is in getting a true emulsion, which can only be done by thorough agitation; this is best done by pumping the mixture into itself for some minutes. When this creamy mixture becomes cold it gets thick and almost solid, and there should be no trace of free oil on the surface.

If there is still unemulsified oil, the best plan is to add some more boiling soap solution and stir again.

Free oil destroys the foliage. Be sure and get the best kerosene and good soap.

Kerosene being highly inflammable, pay particular attention to the directions for doing the mixing well away from the fire. Boil the soap and water in one vessel, and carry it away from the fire before mixing with the kerosene. Any kind of vessel may be used.

Kerosene attacks india-rubber, consequently the tubing, and indeed the whole spraying outfit, must be well washed with hot water directly after use.

Sometimes it is of advantage to prepare a quantity of emulsion as a stock-quantity. When this is done, and it is required to dilute it to make up a spray, this should be done by adding boiling water to it, and not by melting it over the fire, which is dangerous, especially indoors.

(d) Paris Green.

This should be mixed at first with water in the way that mustard is prepared. There is nothing to note in its preparation. It may be made in any suitable vessel, and it does not require boiling.

Paris green is excessively poisonous, and must be handled with caution.

There are two, perhaps more, grades of Paris green in the market. One of these is mixed with Barium sulphate (baryta), and is sold for use as a pigment. Be sure, therefore, to ask for pure Paris green for spraying purposes.

The addition of sulphate of baryta can hardly be called an adulteration, as it is added to give "body" to the pigment; but it renders it less effective as a spray.

Sulphate of baryta is white, and can often be recognised by simply crushing any lumps present.

Tests for Paris Green.

Pure Paris green is a light green powder. It contains copper and arsenic, and is an arsenite of copper. It does not dissolve in water, but when pure dissolves readily in any common acid or in ammonia, with the latter forming the deep blue colour characteristic of salts of copper. When either acids or ammonia are used, any sulphate of baryta present can be at once detected, as it will remain undissolved in the form of a heavy white powder.

Fruit Growing, Drying, and Curing,

WITH A FEW SIMPLE REMEDIES FOR THE PREVENTION AND TREATMENT OF SOME INSECT PESTS.

BY W. J. ALLEN,
Fruit Expert.

THE subject of fruit-growing, &c., is a most exhaustive one; but I would like to throw out a few hints to those engaged or about to engage in this most profitable business—only profitable, however, when it receives the best and most intelligent attention.

For the colder districts, apples, pears and plums will be found the most profitable; but plant only a few sorts of such as are good keeping varieties and suitable for export. I would recommend a medium-sized rather than a very large apple, as the retailer finds it most saleable.

Varieties to Grow.

For apples the following are some of the best varieties, viz.:—Jonathan, Munroe's Favourite, Cleopatra, Esopus Spitzenberg, Sturmer Pippin, Adam's Pearmain, Rome Beauty, Rymer, Winter Greening, Five Crown Pippin, King of the Pippins, Perfection, London Pippin.

Amongst pears, the Bartlett or Williams' Bon Chrêtien stands first as a dessert and canning pear; but it will not stand long-keeping. Other good varieties, which combine the qualities of the finest dessert pears, and are excellent for shipping purposes, are (1) Bergamot "Gansel's," Marie Louise, and Duchess d'Orleans; (2) Beurre Bosc and Gregoire Bourdillon; (3) Beurre d'Aremberg, Pitmaston Duchess, Doyenne du Comice (one of the very best), Duchesse d'Angouleme, and Marie Louise d'Uccle; (4) Beurre Diel, Beurre Bachelier and Chaumontel; (5) Winter Nelis, Josephine de Malines, Marie Benoist, Zephirin Gregoire, and Duchesse de Bordeaux; and (6) Bergamotte d'Esperen, Easter Beurre, Beurre Rance and Doyenné d'Alencon. These ripen from early winter until late spring, in the order arranged.

In plums we have Pond's Seedling, Pacific (good shipper), Jefferson, Decaisné, Prince Englebert (good shipper), Angelina Burdett, Burbank, Giant and Coe's Golden Drop.

Prunes, which will be found to do much better in the colder than in the warmer districts, deserve to have received a greater share of attention than they have hitherto. Robe de Sargent, Prune d'Agen, Steptoe (a new American variety), Silver (which is almost identical with Coe's Golden Drop), and Italian (which is particularly suited for the colder climate), being among the best known for drying purposes.

Apricots and peaches require a dry and warm climate to be seen in perfection, as is shown by the fact that the best of these fruits are produced in districts where nothing could possibly grow unless under irrigation, particularly where the fruit is to be grown for drying purposes. Of course, good peaches and apricots for dessert purposes can be grown in most districts; but they do not attain the same richness of flavour, the fine texture, and the rich colour necessary for first-class dried fruits.

Of apricots, although there are many varieties, yet only a few are worth planting. Of these, Moorpark, Alsace, Blenheim, Royal, Mansfield Seedling, Hemskirke, and Kaisha are the best.

Whilst of peaches, Brigg's Red May (early dessert), Early Crawford, Late Crawford, Elberta, Globe, Picquet's Late, Susquehanna, Comet, Lady Palmerston, Salwey (very late), are, without a doubt, the best peaches now raised; and the latter nine combine all the qualities of a first-class dessert fruit, as well as being those best adapted for drying and canning, and are all free-stone.

Cherries are suited to the colder districts, and of these the Centennial, St. Margaret's, Black Tartarian, Florence, Bigarreau Napoleon, Early Purple Guigné, Claremont, Weader's Early Black, are a few of the best.

Lemons and oranges will do in almost any district where hard frosts are not of frequent occurrence, and thrive in light or dark free soils with a porous subsoil. The Lisbon lemon as yet has proved itself best adapted to the Australian climate; but the Villa Franca is fast growing in favour, and either will prove profitable.

The following are some of the best varieties of oranges, and I would strongly recommend those having orange orchards of those old varieties which are full of seeds, to refill, wherever and whenever a vacancy happens, with the newer and more paying varieties, namely, Washington Navels, Late Valencias, Little St. Michael or Paper Rind, Blood, Mediterranean Sweet, Ruby, Joppas (this latter a very late bearer), Beauty of Glen Retreat Mandarin and Emperor Mandarin. For marmalade I would recommend growing a few Seville oranges.

Raisin grapes will only pay when grown in warm, dry districts and in light soils, as, to produce a good table raisin, the berry must be large, of good flavour, and with plenty of sugar, and thin-skinned. The Gordo Blanco and Muscat of Alexandria are the only ones I can recommend.

Drying.

In drying prunes, place the fruit in wire or perforated metal baskets, and immerse these in the lye, keeping the basket moving or twirling for a space of from five to ten seconds, according to the condition of the fruit, or just long enough to crack the skin slightly (this being of great assistance in drying). This lye is made in the proportion of 1 lb. of concentrated lye added to 10 or 12 gallons of water, the quantity to be determined by the quality of the fruit, some kinds being tougher in the skin than others. Boil the lye and dip the fruit when just on the boil. After removing from the lye rinse the fruit in fresh water, then spread on trays and place in the fumigator, where it will remain from half an hour to an hour and a half, or just long enough to give the prunes a nice light colour. (I might mention here that only the silver and light-coloured prunes are subjected to the sulphur fumes, and not the Italian or dark prunes.) Remove from here to the evaporator, or place in the hot sun as the case may be. In the former event the temperature should be about 130 degrees to start with, and increased to 170 or 180

* In next issue Mr. Allen will deal fully with this subject.

degrees, this usually covering from one to two days, according to the size of the fruit. The fruit when done should be pliable, and after removal from the evaporator should be allowed to lie in sweat-boxes for a fortnight to even up, when it can be graded and neatly packed in boxes lined with white paper.

Apples should be peeled, cored and sliced, and subjected to sulphur just long enough to whiten them before putting in the evaporator; but great care must be taken not to overdo the sulphuring, as much fruit is rendered worthless through a few minutes' neglect. Allow the fruit to remain in the evaporator until sufficiently dry—that is, from six to eight hours—exposed to a temperature ranging from 140 degrees to 160 degrees. Care must be taken not to allow it to burn or bake, as it would in either case harden as soon as exposed to the air. Then put into the sweat boxes for a few days so as to even up the whole.

Apricots are best dried in the sun; but where this is not practicable they may be dried in the evaporator, subject to the same temperature as prunes, but they will dry in slightly less time owing to the fruit being halved. The apricots should be cut evenly and neatly into halves, removing the pits. Place the halves on trays made for the purpose (keeping the cut side up), and place in the fumigator for eight hours; but only sufficient sulphur should be placed in the fumigator to keep the fumes going three hours—about $2\frac{1}{2}$ lb., or according to the size of the room—this quantity being sufficient for a room 10 feet by 10 feet. Leaving the fruit in the fumigator after the fumes are spent tends to bring out the juices and makes a very much brighter dried fruit.

Peaches are best when peeled, and this, with some varieties, can be done more easily after the fumigating process, as, with the least pressure of the thumb and finger the skin will slip off—otherwise it is advisable to use a machine for the purpose. In every other way they are treated similarly to the apricots, except that they are only allowed to remain in the sulphur room about two hours. When apricots and peaches are dried in the sun with a temperature of 110 degrees in the shade, the process will take from three to four days. I might say here that all fruits must be thoroughly ripe before drying, or failure is the result.

Raisin grapes, if for pudding raisins, should be dipped in a lye made in the proportion of 1 lb. of caustic soda to 8 gallons of water, being allowed to remain in this lye for three seconds while it is just off the boil. Sultanas require the same strength of lye, but two seconds is long enough for them to remain in the dip. Zante currants and grapes intended for layer or table raisins are not dipped, and should never be exposed to a sun which is over 96 degrees in the shade, or the fruit is burnt and the flavour damaged to a great extent.

Simple Remedies for the treatment of some Insect Pests.

1. *Resin wash.—Wash for citrus trees infested with red, brown, black, white, or cottony Cushion Scales.*

Resin	20 lb.
Caustic soda (70 per cent.)	6 „
Fish oil	3 „

Directions for preparing.—Place the above in a large boiler, add 25 gallons of water, and boil three hours, adding hot water while boiling, up to 50 gallons; then after cooking add cold water to make the whole up to 100 gallons. Never add cold water while cooking. Apply when quite warm.

2. *For Aphis upon plum, prune, and apple trees, woolly aphis, &c.:—*

Caustic soda, 98 per cent.	1 lb.
Resin	6 „
Water	40 gallons

Prepare as directed in resin wash.

3. *For Black Scale on Olive Trees.*

Kerosene (150° test)	5 gallons
Common Soap	$1\frac{1}{2}$ lb.
Water	$2\frac{1}{2}$ gallons

Dissolve the soap by boiling in the $2\frac{1}{2}$ gallons of water, and while boiling remove to another vessel; add the kerosene and churn for fifteen minutes, or until a stable emulsion is formed; afterwards dilute with $6\frac{1}{2}$ gallons of hot water for each gallon of oil, and to the mixture add $2\frac{1}{2}$ lb. of soft soap dissolved in hot water. Apply at a temperature of 140 degrees F.

4. *For Codlin Moth, Canker or Measuring Worms, Pear or Cherry Slugs.*

Spray the trees with 1 lb. of Paris Green to 200 gallons of cold water. To render the Paris Green more insoluble, and thereby prevent injury to the leaves, dissolve 6 lb. of fresh lime in water and add this latter to the solution. Keep the mixture constantly stirred when spraying. (Paris Green should be made into a paste same as mixing mustard before mixing it with the water.)

5. *Lime, Sulphur, and Salt for winter use upon deciduous trees.*

Unslacked lime	40 lb.
Sulphur	20 „
Common Stock Salt	15 „

Directions for preparing.—Place 10 lb. of lime and 20 lb. of sulphur in a boiler with 20 gallons of water, and boil over a good fire for not less than $1\frac{1}{2}$ hours, or until the sulphur is thoroughly dissolved. When this takes place the mixture will be an amber colour. Next place in a cask 30 lb. of unslacked lime, pouring over it enough hot water to thoroughly slack it, and while it is boiling add the 15 lb. of salt. When this is dissolved add to the lime and sulphur in the boiler, and cook for half an hour longer, and add the remainder of water to make 60 gallons.

6. *For Shot-hole and other Fungi.*

The trees should be sprayed with lime, sulphur and salt remedy before the buds start, and as soon as the fruit is set, with the following: Dissolve 6 oz. of common glue by boiling in 1 gallon of water, and 2 lb. of carbonate of copper in 4 gallons of water—then mix the two, stirring well. Dilute with warm water to make 100 gallons. Keep constantly stirred, and apply with a fine spray.

Bordeaux Mixture is also a good remedy for the above.

7. *Bordeaux Mixture.*

For Apple Scab, Leaf Blight, Black Rust in Plums and in Cherries, Rot in Cherries, Rust, Black Rot in Vines, Downy and Powdery Mildew, Ripe Rot, Mildew on Gooseberries, Disease of the Passion Fruit, &c.

Copper sulphate	6 lb.
Quicklime	4 „

Water, 45 gallons for summer and 22 gallons for winter.

Dissolve the copper sulphate in 4 gallons of hot water. Use an earthen or wooden vessel. Slack the lime in 4 gallons of water, then mix the two and make up to either 22 or 45 gallons according to the season. It will adhere better if about 1 lb. of hard soap be dissolved in hot water and added, or 4 lb. of molasses may be used instead of the soap.

8. *Black Spot or Anthracnose on Vines.*

Sulphate of iron	5 lb.
Sulphuric acid	½ „
Water	1 gallon.

Pour the sulphuric acid over the sulphate of iron and pour the water over this. Apply with a brush just as the buds begin to swell in the spring. Two applications will be found better than one, applied ten days apart.

9. *Kerosene Emulsion for Rose-beetle, Rose-bug, Pear Leaf Blister, Black Peach Aphis (above-ground), Plant Lice, Melon Louse, Woolly Aphis (above-ground), Plum Scale.*

Hard Soap	½ lb.
Kerosene	2 gallons
Boiling Soft Water	1 gallon.

Dissolve one-half pound of hard soap in one gallon of boiling water, after which the kerosene is added, and the two churned for ten minutes. One essential condition of success in making this emulsion is that the liquids should be as warm as possible. It is also necessary that the water be as soft as possible. For summer spraying dilute the above in sixty gallons of warm water.

10. *Woolly Aphis on Roots of Apple Trees.*

Remove the earth with a hoe from around the trunk of the tree for a distance of two feet and to a depth of four to six inches. In this excavation distribute evenly from one to four pounds of tobacco dust, care being taken to place it close to the trunk also. Then cover over the tobacco dust with earth. Repeat this treatment in two months' time.

Report upon Insect Pests found in the Northern District.

May, 1897.

By WALTER W. FROGGATT,
Government Entomologist.

The following notes are compiled from observations upon insects met with in the Tweed and Richmond River Districts during my late visit there. Going *via* Brisbane, my first collecting was done in the vicinity of Southport, Queensland, while waiting for the coach to the Tweed River Heads. The country round this watering-place consists of poor sandy soil covered with a low scrub of banksias, melaleuca, leptospermum, eucalypts, and other small shrubs, or open ti-tree swampy land.

This country was found to be rich in scale insects, and I obtained specimens of the large gall-making coccid, *Brachyscelis pileata*, Sch., not recorded from so far north before, and *Sphærococcus melaleuca*, Mask., as well as a very curious species (evidently new, belonging to this genus), that covered the melaleuca with small reddish rounded balls consisting of a number of bracts radiating from a common centre. This last gall was found from here to Palmer's Island on the Clarence River. Two scale insects, *Lecanium bacctatum*, Mask., and *Prosophora acaciæ*, Mask, were found upon the wattles, and *Aspidiotus Rossi*, Mask., and *Aspidiotus camelliæ* upon eucalypts. Two species of white ants (*Termitidæ*) were obtained, the nests of the large one (*Termes lactis*, Frogg) having been noticed along the line from Brisbane; the other *Eutermes fumipennes*, Walk., being common under bark and logs. The Tweed River with its sub-tropical wealth of plant life, though my stay was necessarily short, was found to be rich in insects even in the winter, many of the indigenous species having invaded the cleared land and attacked cultivated plants and crops.

The Chrysomalid beetles are naturally most numerous, the members of the group of "flea-beetles" (*Haltericides*) were much in evidence. They take their popular name from having the thighs of the hind legs swollen out into a rounded lump, upon which they can spring to a considerable distance when disturbed. They feed upon the upper surface of the thick leaves, but they gnaw into holes those of finer texture. They are generally of small size, of dark metallic blue or bronze green colour. Several species were found upon sweet potatoes, cow peas, and other cultivated plants.

Wherever the wild bramble (*Rubus* sp.) was found growing numbers of the curious double-tailed larvæ of the Bramble saw fly (*Philomastix glaber*, Frogg.) were found feeding, together with the fully-developed saw-flies, which cling to the plant, and never attempt to fly away; the males of

this species are very rare. The handsome chrysomalid beetle (*Spilopyra sumptuosa*, Baly.) was taken in numbers upon a small shrub in the forest country.

At Mr. Lily's I examined a potato-field, in which he had found the plants dying off in a most unaccountable manner, but close examination showed that it was caused by a small moth grub feeding in the stem. Some grubs were obtained, but died in the pupal state.

At Mr. G. Pettigrew's request, I examined the foliage of his late maize attacked by the so-called "maize blight," but cannot agree with the conclusions that he arrives at, that it is caused by the attacks of small Homopterous insects, commonly known as "froghoppers," for though there were great numbers of at least half a dozen species, they were more among the weeds than on the maize. Though the leaves were discoloured from the tips, the area of discolouration was too large and regular to be caused by their punctures, and showed no centre of infection, as would have been the case if pierced by their rostrum.

I believe that the "maize blight" is not caused by insects, but more likely from the want of some chemical constituent in the soil.*

The most destructive pest, as far as maize is concerned, is the "American boll worm, or maize moth" (*Heliothis armiger*), for it attacks both maize and cotton, as well as many other plants, both in the United States and these colonies. In several fields visited, nearly 75 per cent of the cobs were attacked, the grubs invariably crawling into the tassel or silk of the maize and gnawing downward into the tip of the cob, feeding on the corn until ready to pupate when they crawl down and bury themselves in the soil, but leave behind them a rotten mass, which when it becomes wet, destroys half of the corn. Yet none of the maize-growers seem to bother to get rid of these grubs, though when first attacking the tassel they could be easily hand-picked. There is no doubt the insectivorous birds greatly mitigated the evil in old times, but the indiscriminate slaughter of such feathered friends, as the magpie lark, the different robins, thick-heads, magpies, summer birds, and many others, has ended with the natural result that noxious insects have increased since the check has been removed. It is to be greatly regretted that more stringent regulations are not enforced for the protection of our useful birds. If the farmers only recognised the true value of the birds, they would protect them as carefully as their poultry. Most of our insectivorous birds are of such a friendly disposition as to be easily destroyed by the pot-hunter, and this last season, in the Liverpool district, I saw both magpie larks and flycatchers shot for sport. In the propagating-grounds of the Botanic Gardens there is a small mob of the former which are so tame that they will hardly fly out of one's way, and this most graceful bird is one of our best insect-hunters.

The slender green caterpillars of "the silver spotted plusia" (*P. verticellata*) were taken upon the cow-peas, while the larva of one of the larger hawk moths had evidently been feeding upon the foliage of the sweet potatoes. A few of the old orange trees were more or less attacked by "borers"; but there are comparatively few fruit trees now grown about the settlers' homes, though at one time I am told there were some very good orchards on the Tweed River.

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* For information in regard to the supposed cause of "maize blight," see "maize disease" in Mr. H. Tryon's Report on Insects and Fungus Pests, Queensland, 1889, pp. 199 and 209. Here a number of reports are collected and printed together with Mr. Tryon's own observations upon the matter.

At the Wollongbar Experiment Farm, I was struck with the absence of scale insects among the many different kinds of plants and trees. One tree near the house, which had been completely denuded of its foliage by the larvæ of one of our native silkworm moths, had the limbs and twigs so thickly covered with the "Indian wax scale," *Ceroplastes ceriferus*, as to look as if it had been painted; but this had been kept as a sample for me. A patch of red clover was thickly covered with *Icerya nudata*, Mask., which crawled about, and clung to the leaves, though the plants did not seem to be much affected by their presence.

Monolepta rosae (one of the Chrysomalid beetles), which the manager (Mr. McKeown) tells me is very plentiful at some seasons on the farm, were noticed covering one orange tree, and destroying all the young foliage. The late Mr. A. S. Olliff has given a description and some account of the habits of this beetle; but the early stages of its development are still unknown. The pumpkin beetle (*Aulacophora oliverei*) were pretty numerous in many parts of the farm; but Mr. McKeown says he can keep both these leaf-eating beetles in check by spraying with Paris green.

The cotton plants seem to be greatly favoured by the members of the order *Hempteria*, several large bugs being always found upon them, the harlequin fruit-bug (*Dindymus vericolor*) being one of the commonest. A short olive-green caterpillar covered with dark spots, also gnaws into the bolls, to feast upon the seeds. This is allied to, if not identical with, the peach moth (*Conogethes punctiferalis*), which is very plentiful among the castor-oil plants, the caterpillars gnawing their way into the hollow stems and eating out the pith, where they afterwards pupate.*

Another moth (*Achaea melicerte*, Drury) also attacks the castor-oil trees, the larvæ feeding upon the foliage, a detailed description of which is given below. Some bushes of fennel seemed to be very attractive to many different insects flying about the flowers, such as ichneumon wasps and flies, while upon the stem were found a small weevil (*Lixius marstersi*) and the shining longicorn (*Temnosternus planusculus*, Macl.)

The seeds of *Acacia farnesiana* were very badly infested by the larvæ of a handsome little moth (*Arotrophora ombrodelta*), hardly any pod being sound. The life history of the moth is appended.

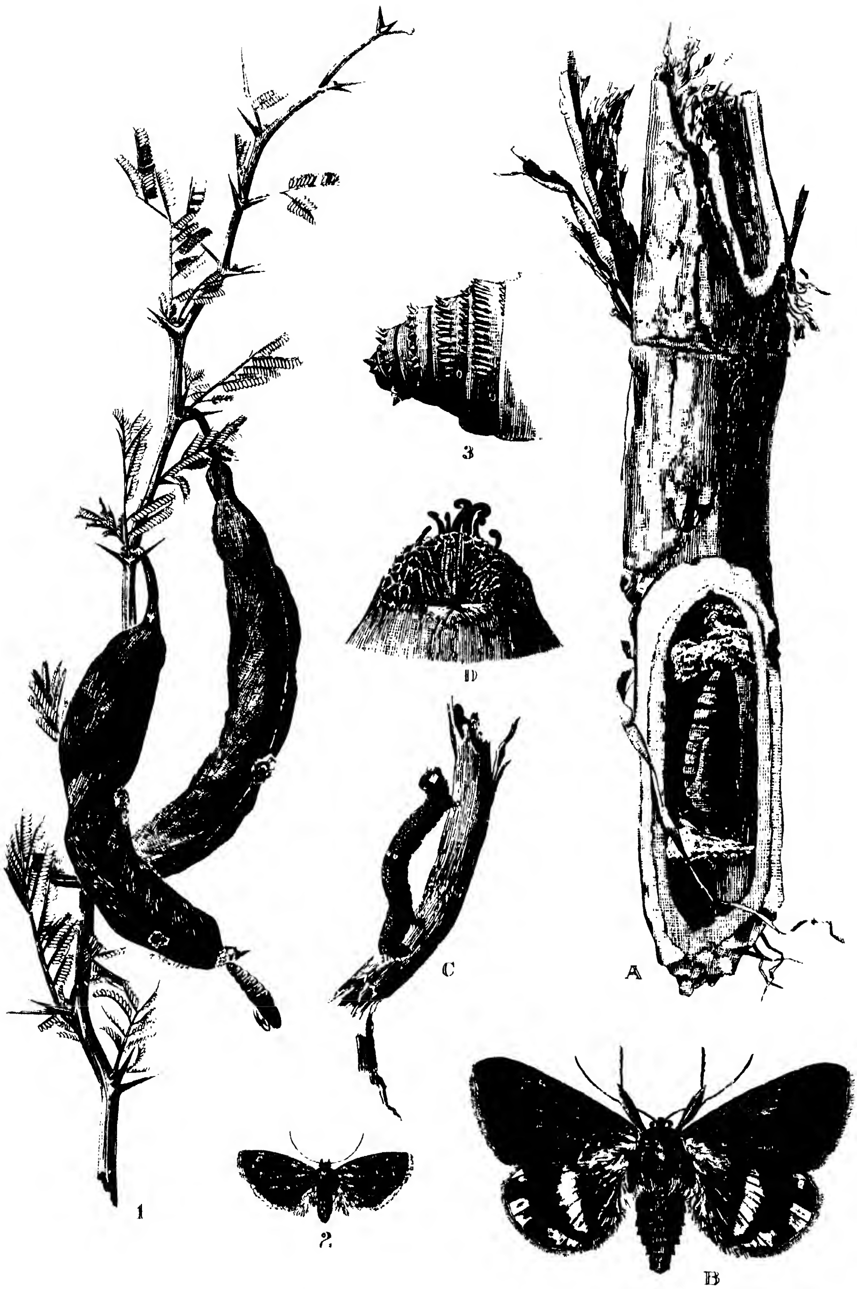
The fruit fly (*Tephritis Tyroni*, Frogg.), which was not noticed on the Tweed, was found at Wollongbar hovering round every orange tree that still bore fruit, and all the fruit examined contained their maggots. A large number of larvæ collected in the forest and scrub under logs and stones, or cut out of logs, were brought down to Sydney, and are now being kept to work out their life histories.

The great number of the larvæ of the peach moth (*Conogethes punctiferalis*, Gn.) were noticed feeding upon the dead flower-buds, and afterwards upon the pith of the dead stalks of the castor-oil plants, while a very similar larvæ was found feeding upon the cotton seeds in the ripening bolls.

The Castor-oil Tree Moth (*Achaea melicerte*, Drury).

These caterpillars are common upon the foliage of the castor-oil trees, stripping off the foliage, and, when ready to pupate, crawling into the hollows in the dead branches.

* This has been bred out in numbers since these notes were written, and proves to be the moth named.



The Acacia-pod Moth.
(Arotrophora ombrodelta, Lower.)

1. The Pods affected.
2. The Moth.
3. End Segments of the Larval Tube.

The Castor-oil Tree Moth.
(Achaea melicerte, Drury.)

A. Stem showing Pupa.
B. The Moth.
C. Larva.
D. Anal Segment showing hooks.

The caterpillar measures about $1\frac{1}{2}$ in. in length, and is of a general reddish chestnut brown, the centre and the lower half along the sides of the segments blackish brown, with the chestnut colouration forming a stripe on either side; the head mottled with creamy white spots, forming a big blotch on either side; the front of the second thoracic segment marked with smaller spots; legs, reddish yellow, with the claws black, the claspers blotched with white. The caterpillars vary considerably in colour, some being very much darker than others.

The pupa measures an inch in length, and is dark-brown, but covered with a white floury substance that rubs off very readily; the head broadly-rounded, with the tip of the wing-cases reaching to the fourth abdominal segment; the anal segment curiously striated, terminating in two slender curved wire-like hooks, with six smaller curled ones round them, three on either side. The caterpillars were plentiful upon the trees on the 17th May, and they pupated about the end of the month.

When ready to transform, they crawl down into the hollow stem of a dead branch, forming a silken web on either side, and attaching themselves by the anal hooks to the upper partition, hanging head downwards. In captivity some pupated on the floor of the breeding-cage, but others formed the dead leaves into a rough cocoon. The first moth emerged at the end of May, and the last towards the end of June.

The moth measures $2\frac{1}{4}$ inches across the wings; the fore-wings of a light-brown, clouded with a bronzy chocolate colour towards the tips, marbled with irregular wavy transverse markings, with a more distinct band about a third from the shoulder; the hind wings are grey at the base, with a broad transverse white stripe between it and the apical portion, which is rich blackish brown, with three irregular white blotches along the outer margin.

Mr. Lyell, of Victoria, informs me that the larvæ of this moth feed upon the foliage of the rose as well as the castor-oil plant.

This moth has a wide range. In the British Museum Catalogue it is recorded from India, Ceylon, Celebes, and Moreton Bay, Queensland. Balfour, in his work on the "Agricultural Pests of India," speaking of this moth, says: "The larva is called Thondala hoola by the Canarese. They feed upon the castor-oil plants, the leaves and flowers of which they eat; on two or three acres of land, in one night, they will leave nothing but bare branches. The plants seldom survive their attack, and at best yield only one-fourth of the produce. The cultivators drive them from the plants by smoking, but this is impossible of application when seeds are sown on an extensive area, in which case the husbandman gives up all hopes of the crop."

The Acacia-pod Moth (*Arotrophora ombrodelta*, Lower).

In examining some ornamental acacias (*Acacia farnesiana*) growing upon the farm, every pod was found to be more or less infested with a small lepidopterous grub, which I afterwards bred out. Upon submitting specimens to my friend, Mr. Oswald Lower, of Adelaide, South Australia, he informs me that it is a new species, which he has described under the above name.

Mr. Meyrack says of one species of this genus: "The larva feeds in a short stiff silken tube amongst the leaves of *Lomantia silarfolia*, discolouring them conspicuously; pupa in a fine silken cocoon, covered with refuse within the end of the tube." And of another species: "Larva feeds in flower cones of *Banksia serrata*, burrowing through the substance of the cone whilst the seeds are forming." I am indebted to Mr. Lyell for these references.

The caterpillar is of a uniform dull yellowish brown, but sometimes with a greenish tint; a pink stripe down the centre of the back, and each segment spotted with olive-green marks.

Length when full grown, 8 lines. They bore into the side of the pod and feed upon the seed, and when full grown spin a silken cocoon with the head pointing towards the hole in the pod through which the moth afterwards emerges.

The pupa is bright reddish brown, under half an inch in length; the head portion small and rounded, with the antennæ not folding close to the legs, but curving round on either side over the wings, the tip of the wing extending to the fourth abdominal segment; the thoracic portion rounded above with a median suture; the abdominal segments deeply marked on the upper edge with dark brown; each segment, except the first two, armed with two transverse bands of fine short spines curving downwards, but not extending round the underside. When the moth emerges the pupal case is worked through the hole in the pod so that two thirds of it is protruded before the moth escapes.

The moth measures from 11 to 9 lines across the wings; the fore pair of a chocolate-brown colour, mottled, and darkest at the tips. The hind margin, from the shoulder to about two-thirds of the length of wing, marked with an elongated oval stripe, while just beyond it is an angular rich chestnut coloured spot (looking almost black until examined with a lens). The hind wings brown, both pair thickly fringed with scales, and the head and thorax thickly covered with dark brown scales; abdomen lighter coloured.

The pupæ are plentiful in the seeds about May, and were pupating towards the end of June, the first moths emerging in August, but a great number still in the cocoons.

To get rid of these destructive seed-eaters all the pods should be gathered as soon as ripe and put into a jar where they could be treated with bisulphide of carbon.

Profitable Poultry Breeding for the Local and English Markets.

GEO. BRADSHAW.

(Continued from page 643.)

CHAPTER IX.

The Mediterranean, or Non-Sitting Breeds.

WHERE eggs are the only object in view in poultry keeping, what are known as the Mediterranean Breeds will be found the most profitable, the most popular being Minorcas, Spanish, Andalusian, and Leghorns. The male birds of these varieties all have large, single, perfectly upright combs; the hens' combs also large, soft, and falling over to one side. They are all rather long in the legs, and the bodies are not so heavy as in several other varieties. They have white ear lobes, and are prolific layers of good-sized white eggs. Are rather deficient in breast meat, hence are not regarded as useful table fowls.

Minorcas.

This breed, as it existed a number of years ago, was a more compact bird than that exhibited at the present time. They have large, evenly serrated combs, red face, with an almond-shaped white ear lobe, the legs are black and flesh white. Although not a great fattener, the Minorca is the very best layer we have, the eggs are large, and wonderful figures have been published as to quantities, but allowing the usual discount for interested returns they are left with a record far in excess of any other breed, while the great numbers annually exhibited at the leading shows, and being more generally kept than any other pure variety, is evidence sufficient of their popularity, whether as an exhibition bird or a useful domestic fowl. They can be kept profitably, whether on the free range of a farm-holding or in the confined run of the suburban poultry keeper, the extreme temperatures of the winter or summer months little affecting them for ill. The chickens are easily reared, the cockerels are very precocious, and the pullets lay at an early age. When having a free run they can be very cheaply fed, being good scavengers for natural foods. To improve the Minorca as a layer by crossing need not be attempted, but the breed can be used to the greatest advantage for improving the laying properties of a yard of ordinary farm poultry. A male bird of this breed will suffice for every dozen hens; and in selecting such, exhibition specimens are unnecessary, purity of breed and good size, combined with a vigorous constitution, being chief considerations. Minorcas are plentiful in the colony, consequently there should be no difficulty in procuring birds well suited for the above purpose at reasonable prices.

Andalusians.

Another of the non-sitting breeds, closely allied to the preceding variety, and, like them, specially valued as producers of great quantities of large white eggs. They have a colour peculiar to themselves, which may be described as a slate blue, with an edging or lacing of a darker shade on each feather. The neck hackles and top feathers of the male birds are a beautiful dark purple inclining to black, combs erect with red face, and white ear lobes, the hens' combs, like that of the Minorca, falling over to one side, but of much smaller proportions. Andalusians are a very unsatisfactory breed of poultry to keep—this resulting from the great difficulty in breeding them true to colour, it being a well-known fact that the progeny from a pair of properly coloured birds would in a couple of seasons be found to be of a very mixed appearance indeed—some almost black, others nearly white, many mottled, and not a few minus any lacing whatever. For this reason they are considered more of a fancier's fowl; and even the most experienced breeder finds great difficulty in producing the show-pen requirements in anything approaching perfection. The variety has not now many admirers in the colonies, and as a result they do not make a large show at any of the Colonial exhibitions. As table poultry they cannot be recommended; but to those regardless of the colour of their flocks the breed will supply them with quantities of large white eggs.

Leghorns.

In the whole history of pure breeds, possibly there is none which has taken such a firm hold with breeders as have the white and brown Leghorns; for while other varieties came, had their rush, and then declined in public favour, the Leghorns came and *stayed*. Although always spoken of as splendid layers, their introduction was not heralded as anything extraordinary in that way; but they have proved themselves as egg producers worthy of the highest place. Some ten or twelve years ago they became well known to Australian breeders, and have to the present day attained a high position amongst the best egg-producing varieties we have got. They are largely bred throughout all the colonies—farmers, suburban poultry keepers, professional and other exhibitors all being warm patrons of the breed. Although rather a small variety of fowls, well grown birds of a good strain produce in great quantities eggs of a fair marketable size. Like the preceding, they are non-sitters; hardy; and little difficulty is experienced in rearing chickens, which soon mature. The pullets commence to lay early. They are small feeders, and where a free run is available they go a long distance in search of natural food. Leghorns require new blood introduced frequently, otherwise they deteriorate in size, the accompaniment being an egg of less marketable value. Buffs in this variety have lately been introduced to the colonies, but in such limited numbers that reliable tests as to their merits are not yet available. It is claimed for Leghorns that they cross well with several other varieties; but as they are rather a small fowl, the advantages, at least to the writer, are not apparent.

Spanish.

"Black Spanish" for a great number of years was a household word amongst all poultry keepers, and for a long time held chief honors as egg producers, and were extensively kept by the large majority of the then poultry breeders.

They have, however, long since fallen from their high estate, and are now one of the most neglected breeds we have, all authorities agreeing that the show system and its demands was solely responsible for the breed's decline. Spanish was formerly a most useful fowl, but the great craze of breeding for a face of abnormal length, width, and whiteness, and the artificial means used to obtain these results, have so affected the variety for ill that they are now strangers to the farmer's yard, which was once their home. One well-known English authority wrote of them as follows :—"The show birds are so useless that no one but fanciers would keep them, and as profitable poultry the breed has passed out of existence ; in fact, so few are now kept that in many poultry shows no classes are inserted for them. Again, in the place of the large, prolific, hardy breed, which was formerly known under that name, we have a smaller race, very leggy, and feathering with such slowness that chickens are often seen in prize pens that have not produced their tail feathers ; in fact, the useful qualities of the race have been neglected in breeding for face and ear-lobe." So far as Australia is concerned, both Agricultural and Fancier's Societies provide classes for the breed, but the response in the way of entries is of such a limited kind that it would cause little surprise and less disappointments should the managements excise them from their lists ; and if they did, very few breeders' would be affected. For many years Spanish cocks were used by some suburban breeders' for crossing with other varieties to produce good layers, and with excellent results. However, the breeding for immense face, with its attendant blindness and other ills, have obliged these breeders' to look for substitutes for this one time prolific layer. Possibly the two or three successful Spanish breeders' of the colony would not give them up in favour of other varieties. However, parties wishing to improve their laying stock will find better results in a selection from breeds already described.

CHAPTER X.

Miscellaneous Breeds.

Scots-Greys, Royal-Blues, Hamburghs, Polish, Bantams, &c.

Scots-Greys are a variety largely exhibited in a few of the most populous cities in Scotland, viz., Glasgow, Paisley, Edinburgh, &c. They are marked much like the Plymouth Rock, but for the quality of the meat they rank next to Dorkings. They have but few patrons in England, classes being rarely provided for them in that country. One enterprising Victorian fancier has made several importations of the breed to that colony, but for some, as yet unexplained, reason they have made but little headway, and although of good repute as utility fowls there is little prospect of them having much effect on the poultry markets of the colonies.

Royal-Blues.—"Made in Melbourne" is descriptive enough of the birthplace of the latest candidates for public favour in the poultry world. The breed—for such it may now be called—was first brought under notice some four years ago by the then poultry editor of the *Australasian.* The manufacturer has not given much information as to the varieties used in its composition, but claims for it all the virtues which go to make a useful farmers' fowl. It is large bodied, white fleshed, and in general conformation much approaching the Langshans, the colour being that of the Andalusian. The premier fanciers'

society of this colony and two or three in Victoria provide classes for the breed, and with satisfactory results. They are reputed to be excellent layers, good table fowls, and to breed true to colour, a combination of qualities sufficient to ensure them a prominent place among the generally useful breeds.

Hamburghs.

Hamburghs are bred in black, gold and silver spangled, and gold and silver pencilled. They are layers of remarkable quantities of eggs not large enough for market purposes, and being but small fowls are considered of little commercial value. They are generally understood as purely fancy fowls, and much experience is necessary to produce the accurate pencillings, spangling, other markings, and correct head gear demanded by the judges of the breed. Being light birds and of great wing power, they are difficult to keep in confined runs, are somewhat delicate to rear, and cannot be recommended to those whose object is profitable poultry keeping.

Polish.

Polish are another ornamental breed, hence are of little use either as egg producers or for killing purposes. They are bred for accurate markings, large crests, and other fancy points; but, as poultry for the farm, they have no note. Large numbers of late years have been imported to the colonies, but, being fowls of delicate constitution, have nearly all died out, leaving but few representatives of the breed.

Two or three unnoticed breeds, together with bantams of various kinds, may be considered purely ornamental and of no interest to those for whom this work is intended.

CHAPTER XI.

DUCKS, TURKEYS, GEESE.

WHATEVER question there may be relative to poultry farming results, there is none whatever where ducks are the object. The many scores of successful duck breeders in the remote Sydney suburbs have placed the financial question far outside the region of dispute, this branch of the business and its surroundings being accountable for the late legislation which included poultry farming as a noxious trade. Duck breeding is successfully carried on to a large extent in Botany, Belmore, Kogarah, Bankstown, and several other suburbs, and parties contemplating including this branch of poultry keeping in their operations will gain more practical knowledge of the subject by a few hour's visit to any of these establishments than could be gleaned from written volumes. In commencing duck farming the breeder is at considerable advantage over those whose purpose is fowls only, seeing he has but three or four varieties from which to make a selection; the poultry breeder, on the other hand, having a great number of breeds from which to choose, his difficulties being not lessened by the patrons of the various sorts each claiming a superiority for his favourite.

Farmers, orchardists, and others will find duck-breeding a most valuable adjunct to their other operations, but to this end they must be kept entirely separate from fowls—if not, failure will assuredly overtake them. Ducks are

much more easily reared than fowls, are very hardy, liable to few diseases, grow much more quickly than fowls, can be marketed at an early age, and fetch a good paying price in the local market during eight months of the year. When stocks are plentiful here, and at their lowest, the English market is bare, and if well fattened young ducklings be sent excellent paying results can be attained throughout our overstocked season, facts which prove this a most important branch of poultry keeping. Neither is the question of locality of so much importance as in fowls, although when the soil is of a gravelly nature it is so much the better—indeed gravel or grit of some sort is a necessity to assist digestion, for the quicker the food is digested the more is required, with a natural result of a faster growth, thus enabling the ducklings to be turned into money at a very early age. Rough uncultivated ground will suit best, the shelter from the sun afforded by the bush being an important element to the welfare of ducklings.

The chief breeds of ducks for profitable breeding are Aylesbury, Pekin, and Rouen. Muscovies are also much used for crossing for our local markets.

Cayugas, East Indians, and Indian-runners may be called the ornamental breeds, although the latter have a reputation as good egg-producers, but withal are not likely to occupy a prominent place in breeding for profit, they being of a small size.

Aylesburys.

The Aylesbury duck took its name from the Buckinghamshire town, in and around which many thousands of this variety are every year reared for the London markets. The rearing of ducks is an industry indigenous to the Vale of Aylesbury, and is carried on in a most systematic manner—many thousands of cottagers depending on it for a living for themselves and families. The variety attain a great size at an early age, are rapid growers, the flavour of the flesh being superior to any other breed. Mr. Fowler, a practical breeder, writing of the Aylesburys, describes the enormous quantities that are sent to London in the spring, a ton weight of ducklings from six to nine weeks old being taken every night for months from that neighbourhood to London, where they realise very high prices in February, March, April, and May. Almost every cottager keeps ducks, four or five to each drake. They are usually housed in some out-building, and are all allowed access to the river, and in the evening are driven to their respective homes, the different owners distinguishing them by marks of paint. Hens are invariably used to hatch, three or four broods usually being put to one hen. Incubators are rarely, if ever, used by the duckers.

Mr. Fowler describes as follows the treatment of the ducklings for market:—"They are kept in hovels, or rooms, each lot of thirty or forty separated by low boards, it being quite usual to see 2,000 to 3,000 in one establishment. They are kept dry and clean on straw, their food consisting for the first fortnight of hard boiled eggs chopped fine and mixed with boiled rice and bullock's liver; afterwards barley meal mixed with tallow greaves, horseflesh, or other meat, this being all that is needed to produce ducklings for the table. They are never allowed to go out of their pens, get as much as they can eat, are fed frequently, and always have water before them with gravel at the bottom to assist digestion."

The chief object in both poultry and duck breeding is to get the birds on as quickly as possible, for the sooner they can be marketed the larger is the profit; and, if stock ducks of a larger growth be bred from, the ducklings at eight to eleven weeks old should weigh from 5 lb. to 6 lb. each, and at this age will fetch more in the local or English market than if kept to six months.

In purchasing stock ducks for exhibition, specimens should be avoided, a prolific strain and of fair size being chief essentials.

Aylesburys have pure white plumage throughout, long head, long and flesh-coloured beak, and orange legs, with long deep bodies, averaging about 7 lb. each, exhibition specimens running up to 9 lb.

Pekins.

Pekins are a variety for a long time known, and of Chinese origin, but did not become very general in England until some fifteen years ago. They were heralded into the poultry world as great layers, and at one time bade fair to contest for popularity with the famous Aylesburys. That they are wonderful layers has been long since established; and where the strain has been kept from the show-pen they still continue so—far exceeding the Aylesbury in that respect.

The plumage is white throughout, with a yellow tinge in the under fluff, the absence of this canary shade being strong evidence of the non-purity of the breed. They are very erect in carriage, head short, breast and back wide, beak short, and, like the legs, a bright yellow. Pekins look a much larger duck than the Aylesbury. This, however, is more apparent than real, for, being very soft and loose in plumage, they do not weigh up to appearance. Although a most profitable breed to keep, the flesh is not of so fine a quality as Aylesbury. For crossing with this breed they have many advocates, but the experience of others is to the effect that a good laying strain of Pekins cannot be improved upon in that respect, but the progeny from this cross mature more quickly, and grow to a greater size.

Rouens.

The plumage of this variety is almost identical with the mallard, or wild duck. They have become of late years very plentiful in England, the majority of the farmers in the south keeping this variety. They grow to heavier weights than either of the white breeds, but are generally understood to be inferior layers.

Rouens are not at all plentiful in Australia, probably arising from the fact that white ducks always find a more ready market than coloured ones, while for the export trade they cannot be recommended, from the fact that white ducks have white skin, and when plucked are much more attractive than those with coloured plumage, black pin feathers and dark skin detracting from their appearance and market value.

Ducklings for the English market should be hatched from September to November inclusive, this bringing them to a marketable age (three months) from December to February, and enabling them to be placed on the London markets from March to June, when the best prices are obtainable. During the past three years several thousand Australian ducklings have reached London, and always found a ready sale at from 5s. 6d. to 8s. 6d. per couple, the majority of consignments showing a satisfactory profit to the exporters.

Geese.

Geese should be the most profitable poultry that farmers keep, from the fact that after the goslings are a few weeks old there is no cost for keep—they, being great foragers, travel far in search of food, and require little attention. Hitherto, however, from whatever cause, the Sydney market price for geese

has been low, the demand evidently falling much below the supply—indeed, the price for goslings or geese nearly all the year round is very little more than that obtainable for good ducklings, 4s. to 5s. 6d. being about the normal price; nor is there any reason to believe that an improved quality would much increase the demand, fowls, ducklings, and turkeys finding more favour among Australian poultry consumers. However, this prediction is not intended to convey that farmers should neglect this branch of poultry-keeping, but rather the reverse; for experience has shown that where our fowls and ducklings have fetched in the English markets from 50 to 90 per cent. more than the local price, the few goslings exported realised from 12s. 6d. to 15s. per pair, or nearly 200 per cent. more than the then ruling Melbourne or Sydney quotations.

In breeding geese for export, the only departure from the present method of rearing must be relative to fattening. The present system is to send to market just as brought off the paddock, whereas for the English market they must be fattened. Three weeks of grain feeding is usually sufficient to ensure proper condition. Large stock birds should be bred from, the white Embden preferable; but as there are so very few of these in the Colony, the large and popular Toulouse will meet all requirements.

Turkeys.

It is usually considered that turkeys are the most difficult of all domestic poultry to rear, which to an extent is true. The locality, however, is the key to success or otherwise, and it is now an admitted fact that the whole of county Cumberland in this Colony, no matter of what nature the soil, is unsuited for turkey raising. One well-known and successful breeder in the Goulburn district lately informed me that he tried four different parts of county Cumberland for this enterprise, and, with every care and attention, was obliged to give the business up, the small percentage of poults reared failing to make the undertaking a success, adding, "in the Goulburn district I don't trouble to rear them—they rear themselves," 90 per cent. of those hatched being brought to maturity without either attention or expense. The same thing has been experienced by many others, the inland districts of the Colony being specially suited for the industry.

One great handicap to profitable turkey breeding in New South Wales is the persistency with which farmers stick to the old common inbred stock—the issue of those introduced to the Colony a century ago. However, of late years there have been several importations of the large and handsome American bronze variety, which if properly utilised should impart vigour, constitution, and increased size to the present stock—a welcome and desirable change.

Turkey-breeding for the English market is subject to the same conditions as that mentioned for geese, *i.e.*, they must be fattened some three or four weeks before being killed, otherwise the profits will be much lessened. For the English markets the great thing is to get large size, for, although the birds are sold at per lb., large ones fetch much more per lb. than small ones. Where those weighing 10 to 12 lb. would bring 9d. or 10d. per lb., those weighing 16 to 20 lb. would be worth from 1s. to 1s. 4d. or 1s. 6d. per lb., according to the greater or less supply of these weights. There is little demand for turkeys in England during the summer months, and to make the best prices they should be sent to catch the Christmas markets. The prices obtainable are largely dependent on the quantity of foreign importations, which of late years have grown to an enormous extent.

Chapter XII.

The Best Varieties.

Parties about to commence poultry-keeping, as well as these desiring to adopt more improved methods, with a view of making the undertaking a more profitable one, naturally make the first inquiry as to "the best breed to keep." This is a question necessitating a very general reply; for, of the score or more of breeds described in this work, every one has some individual characteristic or desirable adaptability. Some are moderate layers of large eggs, others producers of great quantities of moderate-sized eggs; some excelling in meat quantity, others valued as quick growers; while a few are superior as regards delicacy of flesh and facility in fattening,—even the much condemned and now unpopular Cochins have at least the merit of being good sitters and mothers.

First of all, I should state that poultry are kept for several purposes—for prizes, for an egg supply or for table-fowls, or both; and that for any of these purposes there is actually no best breed. There are varieties which head the list in qualities which should make them the best breeds for special purposes; but then soil, climate, position, strain, and constitution may affect some of these best breeds to an extent that others with a less favourable character for utility may be the more profitable. One thing in connection with this subject is beyond dispute, viz., that the breed is not yet produced that is a first-class layer of large eggs and stands out as a tip-top market fowl. Orpingtons, Langshans, Wyandottes, and others may appear and be enjoyed as excellent on our own tables; but when we send white-legged Dorkings, or some approved crosses with such, to the London markets, the enhanced price is testimony to their superiority; while for laying purposes, Minorcas, Leghorns, and Andalusians cannot be improved upon. This fact, however, must be remembered, that there are good and bad layers of the majority of pure breeds, and that owing to so little attention being paid to laying qualities, the bad layers are in the majority.

If eggs be the main object, Minorcas cannot be improved upon, and the condition most favourable for laying is a free run, thus enabling the fowls to obtain varied natural foods. They must have protection against extreme heat and cold, renewal of the stock by selling all hens when they cease to lay, at moulting-time, after 2½ years of age, and rearing a greater number to take their place, to be hatched in the three last months of the year. These will commence to lay when six months old, when eggs are at the dearest, and thus keep up the supply till the older hens commence in the spring.

In purchasing stock birds, it should be remembered that poultry fanciers keep their fancy poultry as a hobby, and breed them for show or outward appearance only. They have nothing in common with farm poultry except that they are both poultry.

A breeder of prize poultry breeds to attain the highest standard in fancy points. Laying and table qualities are not fancy points. A good layer of any pure breed is a bad show bird of that breed. The breeder who devotes his attention to layers develops the reproductive organs so as to get the largest number of eggs. Fancy points and ornaments of all kinds in fowls have been long since proved detrimental to the useful birds; hence the farmer who purposes purchasing stock birds of pure breeds will do best for his purpose to procure such from those who breed for egg production, there being several in the Colony who make this class of breeding a speciality.

Where the farmer's object is breeding table-fowls, the selection of the breeds must be guided by circumstances. It is, however, an undisputed fact that Dorkings and Game are the best table poultry for the English markets. If very large birds are wanted for the local trade, crossing is recommended—that is, *first* crossing, for to continue this further is not to advantage. The cross from the pure breeds gives great constitution, early maturity, and in many cases revives other useful latent qualities long lost in the particular breeds. All crosses with the Dorking are good. They have long, full breasts, with plenty of delicate flesh; and if the cross be with a short-legged Old English or Colonial Game, or Indian Game, the chickens will, if liberally fed, require no artificial fattening, but will be in killing condition at any time, and for the English market will be ready at from four and a half to five months old. It must not, however, be inferred that the above are the only good crosses, but rather that they are acknowledged to be the best. At the same time, Colonial Game or Indian Game cocks mated to Wyandotte, Langshan, or Orpington hens will give most excellent results; and as great size is of more importance in our local market than fine quality, those who cater for this branch may find the latter breeds the more suitable, they being of hardier constitution, and more easily reared than the Dorkings.

Another and more numerous class of poultry-keepers are those who combine the two branches, *i.e.*, good table-fowls and a plentiful supply of eggs, and whose wish is to know the best breeds or crosses for such purpose.

It has been over and over again stated, that a combination of both qualities in one breed is impossible to get; and as this must be admitted, then the most useful fowl for the farmer is the one that comes nearest such a desideratum.

To begin, then, it should be stated that a good-sized brown-shelled egg will fetch the highest price on the market, and to procure such we must get some breed or cross which has some Asiatic blood, and this at once brings us to the Orpingtons and Wyandottes—among the new creations, the former possibly the best. They are short-legged, white-skinned, big-bodied, long-breasted fowls, of good constitution, and more than moderate layers, and being of an even black colour throughout, have suffered nothing from being bred for fancy feathers; hence parties starting poultry-keeping for the object named, cannot get beyond this variety, but if for the London market, a Colonial or Indian Game cock mated with Orpington hens will ensure the chickens having meaty breasts at an early age, and being, consequently, always in killing condition. In pure breeds, Wyandottes come next—excellent table fowls certainly, and free producers of brown eggs, scarcely so large as the Orpingtons, but still marketable. Good crosses can also be had from this breed, suitable either for the local or English markets. Wyandotte-Langshan is an excellent cross for both eggs and good table fowls. Of course, a great many other crosses could be recommended, but those mentioned undoubtedly head the list for the desired purpose.

Many readers will no doubt think that as regards the varieties best to breed the above is for all purposes exhaustive enough. There is, however, another and the largest section to cater for, viz., the present farming community, to whom the Colony is indebted for the bulk of its egg and poultry supply. This large body of poultry-keepers are in possession of stocks of ordinary nondescript fowls, inbred, and of all sizes, many of such an age that they have long since become unprofitable, thus lessening the profit on the younger birds of the flock, and contributing to the oft-heard expression "that poultry don't pay."

The farmer, as a rule, is aware of the shortcomings of his stock, and anxious for one of a more remunerative kind, but believing this change would involve the riddance of the entire flock, and the replacement with better, involve a big outlay, the evil is allowed to continue, and the results are unsatisfactory.

Where the fowls of a farm have degenerated from the cause stated, I have to advise that there is no need for a wholesale clear-out, as is too generally believed. The very commonest poultry of the farm cannot only be much improved, but in a couple or three seasons, a strain can be established equal or superior to any like number of pure breeds, no matter where or from whom purchased. To accomplish this, of course sacrifices must be made in the way of killing or selling off all the male birds of the flock, of whatever age, all hens over 2½ years old, and those of very small size, delicate or deformed, thus leaving a stock of pullets and hens all under 30 months old, the majority of which will be in full profit as regards laying. Good-bodied, short-legged cocks of approved breeds should then be introduced at the rate of, say, one cock to every twelve or fifteen hens; either of several breeds will suit.

Dorking cockerels, say the first year, which will bring size into the progeny. Half of the oldest hens should now be disposed of, their place to be filled with an equal or increased number of pullets, the progeny of the Dorking cocks.

Dorkings are not noted as great layers, still these Dorking-cross pullets will be found much better in that respect than either of the parent breeds, and will with proper attention make the foundation for a strain of poultry whose utility qualities will be of the very highest order. The Dorking cocks must be sold off or exchanged, as well as the crossbred cockerels, and a Minorca cockerel introduced the second season, at the close of which the balance of the old common hens must be sold, and their place supplied with the Minorca cross pullets. The stock will now have become thoroughly renovated, and the introduction of a Colonial or Indian Game cock the third season will constitute a strain of fowls which, for whatever purpose, could not be purchased. The breeder can for the fourth year introduce Orpingtons, and each year fresh male birds must be turned in to alter the breed of the preceding year. This changing of stock may appear troublesome. However, if the best results are to be obtained it must be followed. In purchasing these stock male birds, those from 10 to 15 months old will be the most vigorous, and there is no need whatever to get birds with exhibition qualities; purity of breed only is required. It matters not whether the Dorking cock is very light or very dark in colour; whether the Orpington has two spikes in his comb or a dozen; and although very pale or white legs might disqualify an Indian Game cock from getting a prize, for breeding table fowls this show defect would be an advantage. Fanciers who keep poultry as a hobby always have numbers unfit for show, and are pleased to dispose of such at most reasonable prices, and 50s. yearly spent on four or five of these birds will well repay the farmer for his investment.

Concerning the way in which the male birds should be introduced, the order I have mentioned need not be insisted on. The breed which is the more readily obtained may be started with; but should an improved egg-yield be the initial requirement rather than good table qualities, then a beginning might be made with Minorcas, Dorkings to follows. However, as the present farm stock fails most in size, a noted table breed will be the best to begin with.

In connection with the suggestion as to the disposal of all hens over 2½ years of age, some explanation is necessary. Generally speaking, rural

poultry-keepers give little attention to the egg supply from individual hens, many thinking that at the age mentioned they are in full profit. Such an idea is erroneous.

Every female chicken at birth has what is called the ovarium cluster, which is of a fleshy, granular substance, similar in colour to the liver. In this substance, are little yellow dots, which are the ovules, and whether fecundated or not, will at a certain time develop and become eggs, and drop from this cluster into the oviduct, where the shell is formed, and become perfect eggs. These ovules can with a strong glass be counted immediately after birth, and repeated experiments have shown that a good laying strain of hens has an average of 600 of these ovules. Further tests have shown that the average life of healthy hens is about ten years, but eight years exhaust the ovules, which are transformed into eggs, and laid approximately as follows:—

First year...	40
Second "	200
Third "	150
Fourth "	90
Fifth "	50
Sixth "	40
Seventh "	20
Eighth "	10

It will thus be seen that a hen kept after the third year will not produce enough eggs to pay for feed and trouble. The figures, although approximate, are not guess-work; but even should larger or smaller numbers be produced, the figures recorded may be taken as fairly correct. Another and important matter attaching to these figures must be noted, and is to the effect that every hen is capable of laying a certain number of eggs only, and no matter how fed, this number cannot be increased by a single egg. This, of course, is opposed to theoretical writings; nevertheless it is a fact. Stimulating food will not increase the egg supply, but is capable of doing the next best thing, viz., of inducing the ovules to be transformed into perfect eggs more rapidly than with ordinary attention. Some experimentalists, by the use of stimulants, have exhausted the egg supply at the end of five years.

Before leaving this subject I should mention that the French people make their fowls pay better than any other nation, their success being justly celebrated. The business there is a science; they know the sorts that mature quickly, and the best for laying; and although poultry is sold lower than with us, they make handsome profits. One well-known authority lately wrote:—"In France, poultry forms an important part of the stock of the farm, and the poultry-yards supply more animal-food to the mass of the community than the butchers' shops." The main principles of the success of the French are—the best breeds kept for either eggs or table poultry, early hatching, early marketing, liberal feeding, their stock always young, and a constant and quick succession of marketable fowls and eggs. That the same success can be attained here there cannot be a doubt, better stock and improved management being the chief elements to such success; and, finally, it should be the aim of the farmer not to attempt to live by his fowls, but rather to secure an additional revenue from the poultry living on his farm.

(*To be continued.*)

The Cultivation of Saltbush.

We have received from Mr. John Duff, ex-Overseer, Botanic Gardens, and Inspector of Forests, the following letter with respect to this important matter :—

I noticed in the *Herald* of 21st inst. that you are advocating the cultivation of saltbush in the interior districts of this colony, and I have the honor, herein, to offer you my experience respecting this subject, which, I trust, may be of some assistance towards promoting this very desirable object.

In the years 1892-3, I recommended to the Riverina pastoralists the cultivation of saltbush, and other indigenous forest trees and shrubs, in letters to the *Wagga Wagga Express*, offering at the same time to carry out the work for any person desiring to begin it, but the proposal excited no attention.

My plan of operations would be as follows, viz : – To plough and sub-soil plough, to the depth of 20 to 24 inches, and harrow along the dividing fences of each paddock on the pastoral holdings, strips of land 1 chain wide, afterwards erecting inner fences, so as to exclude all live-stock therefrom. Then procure cuttings of the old wood, from ¾ to ½ inch diameter, and 1 foot long of the "old man" saltbush (*Rhagodia*), which species yields the largest quantity of fodder, and plant the cuttings in rows 8 feet apart, and the same distance between the cuttings in the rows, in the enclosed ploughed areas. The ground should be broken fine with a spade where each cutting is planted, and the cuttings afterwards planted and rammed firmly in the soil with a dibble, leaving only 1 to 1½ inch of their tops above ground.

I have planted from 200 to 300 cuttings, as above described, of *Rhagodia*, in the Council Chamber Gardens, Wagga Wagga, and every one of the cuttings rooted.

To practically illustrate to pastoralists the advantages of cultivating saltbush, I would recommend that a plantation, as herein described, be made in the Experimental Farm, Wagga Wagga, and if this work be proceeded with immediately, it is not too late in the season to plant the cuttings, a supply of which could, I think, be obtained from the Mayor of Wagga Wagga, as there are numerous plants of *Rhagodia* in the Recreation Reserves of that town. [There are now 5 acres at Wagga Experiment Farm planted with saltbush to provide cuttings.—Ed.]

Cuttings of the young wood, or tops of branches, would require to be stuck in boxes in a mixture of equal parts of leaf, mould, and sand, and placed in a glass frame, and the saltbush seeds would also require to be raised in boxes, under glass, as the young wood is too soft, and the seeds too small to be grown with any degree of certainty of success in the open ground.

Plantations of saltbush 1 chain wide would contain seven rows of plants at 8 ft. apart, leaving 5 ft. between the two outer rows and the fences, and this would give an average of forty-nine plants to the square chain. In the autumn of the first year of planting the saltbush cuttings would have grown to the height of 4 to 5 feet, and might then be clipped with hedge shears, the clippings raked into heaps and thrown over the fences on either side of the plantation to feed the stock in the paddocks.

Cuttings could also be procured from the saltbush on the expiration of the first year after planting for forming additional plantations, and I have much more faith in the success of growing the saltbush from cuttings of the old wood and layers than from the young wood and seeds, as plants from the two latter would require to be raised and grown to a size fit for planting out by a practical gardener. At the end of the first year of planting the saltbush, all the branches could be layered, an operation easily performed by forming a drill about 4 inches deep in the soil for each branch, pegging them down in the drills, and covering as much of the branches as possible with soil, leaving their tops above ground. The layers root readily, and in a few months could be cut off, dug up,

and planted in new enclosures, which work should either be done in autumn or early in spring, and when one plantation of 1 chain wide by 6 chains long, containing nearly 300 plants, has been established on a run, an abundant supply of cuttings and layers could then be obtained for forming additional plantations as required.

To preserve the saltbush from destruction and prevent its total extinction, it is absolutely necessary to grow it in enclosed plantations, as herein recommended, only cutting the young shoots off the plants for fodder during periods of drought (which does not injuriously affect the saltbush), when grass and other herbage are insufficient to keep the stock alive.

It is well known to pastoralists that the saltbush, which is a very brittle-wooded plant, is quickly destroyed by being broken, eaten down too closely, and all young shoots eaten off as they appear, so that the necessity for growing it in enclosures will be obvious; and it is no exaggeration to state that on all stocked runs whereon the saltbush grew it is now almost extinct.

For producing the best qualities of beef, mutton and wool, it has been proved that no other fodder plants or grasses equal the saltbush, and bullocks fed upon the Murrumbidgee saltbush flats, on Wagingoberembee station, near Narrandera, have realised the highest prices in the Melbourne market; and it has also been proved that animals fed upon the succulent saltbush do not require nearly so much water as if fed upon any other description of herbage. The permanency of enclosed plantations, saving of stock, and keeping the animals in fair condition during periods of drought, would compensate pastoralists tenfold for the outlay in forming these plantations, and would be the means of alleviating much suffering and distress to pastoralists and stock.

Other kinds of dwarf saltbush (*Atriplex*) might be similarly planted in enclosures as well as the cotton bush (*Kochia villosa*), kurrajong (*Sterculia diversifolia*), boree (*Acacia pendula*), and any other species of indigenous fodder trees and shrubs worthy of cultivation. Most of the trees and shrubs above enumerated could be grown from seeds sown at regular distances apart in the enclosures, and it should be remembered that the remaining fodder trees and shrubs are fast disappearing throughout the colony, and that all seedling-plants of the various species are eaten off and destroyed as soon as they appear above ground; so that their cultivation in enclosed areas is the only method that can be adopted to preserve them from total extinction which, otherwise, must inevitably be the result at no remote period. It is worthy of consideration whether it would, or not, be advisable to facilitate the cultivation of saltbush and other indigenous fodder trees and shrubs by pastoralists, to raise plants of same at all inland model farms and sell them to the pastoralists at a nominal cost, only sufficient to defray the actual expenses of raising, packing, and despatching the plants. This would, I think, greatly advance and assist the work, as few of the pastoralists practically understand the best methods of propagating and cultivating the plants.

Trusting that this communication may be acceptable to you, and of some assistance towards preserving from extinction, and cultivating our valuable indigenous fodder trees and shrubs, more especially the "old man" saltbush, which yields the largest quantity of nutritious fodder, grows most rapidly, and is the most easily propagated.

The Influence of Bees on Crops.

(Continued from p. 623.)

ALBERT GALE.

THERE is yet another phase of this subject I intend to deal with. In previous articles I have confined myself to the influence of bees on fruits; in those remaining, I intend dealing with them as florists.

It has been advocated by the very highest scientific authorities for the Darwinian theory of the development of species in the vegetable kingdom, that colours and perfume of flowers have been produced chiefly, if not entirely, by the visitation of bees and other insects—that our brightest coloured flowers have been developed from progenitors of inconspicuous tints, and the highly attractive shades of the blooms of to-day are the result of the showy character of a less-favoured, as regards colour, earlier race. The same is also said to be the reason of our highly-perfumed blossoms; and these two qualities of flowers—colour and perfume—remain dominant as attractive agents to insects. It is further said that the development of colour and perfume have had the effect of educating the visual and olfactory nerves of these insects (bees) in their search for flowers of particular colour or perfume to supply them with their daily bread, whilst they pass over those of a less gaudy colour unheeding. Again, that the markings in the throat or tube of other flowers act as finger-posts or guide-marks to point the bees in the direction they should take to discover where the nectar is situated that contains their food supply. (See "*The Story of the Plants,*" by Grant Allen, "*Cross and Self-Fertilization,*" by Darwin, and others.)

I am not going to attempt to prove that bees have not had an influence on the plant world; I have already acknowledged it elsewhere. Neither am I going to try to disprove that they are not cognizant of both colour and perfume; but that some colours and some perfumes are more attractive to bees than certain others does not in any way accord with my experience and years of observation.

I know that highly intellectual scientists of undoubted veracity have applied numerous tests, and given the results of their observations to the world, to prove that colours and perfumes are the chief signs that act, like the Southern Cross to the mariner, as indicators for bees to steer by in their peregrinations for the discovery of both pollen and honey. It has been conceded again and again that the tests and their results were unfailing proofs of the correctness of these suppositions, *i.e.*, that flowers of very inconspicuous colours, markings, and shapes have developed into the bright and showy colours and forms they now possess that are so attractive to the cultivated eye of lovers of the plant world.

Sir John Lubbock, in "*Bees, Ants, and Wasps,*" referring to the colour sense of bees, says: "The consideration of the causes which have led to the

structure and colouring of flowers is one of the most fascinating parts of natural history. Most botanists are now agreed that insects, and especially bees, have played a very important part in the development of flowers. While in many plants, almost invariably with the inconspicuous blossoms, the pollen is carried from flower to flower by the wind, in cases of almost all large and brightly-coloured flowers this is effected by the agency of insects. In such flowers, *the colours, scents, and honey serve to attract insects*, while the size and form are arranged in such a manner that the insects fertilise them with pollen brought from another plant." The *italics* are mine.

Whilst I am writing I have before me in the garden the white Arum lily (*Arum africanus*). A few weeks ago its white pollen was eagerly sought for by bees. At the same time the broad beans were in full bloom. These, too, were an attractive foraging-ground for the same insects. Since then the peach-trees have burst into flower, with the result that the first-named is entirely forsaken, and the second receiving only an occasional visit. Have the bees gone to the peach-trees because of their attractive colours? Not a bit of it. While the peaches are in flower so are the willows (*Salix babylonica*) just throwing out their catkins. The bees are now bringing in pollen of two colours, one creamy white and the other somewhat of an orange tint. I note that in this (Stanmore) district there are roses, marigolds, Arum lilies, and other attractive flowers in full bloom, but few bees are visiting them. The pollen is coming from the willows and peach-trees. There is also honey coming from the latter. The flowers (catkins) on the willow are so inconspicuous that a large number of people are ignorant of the fact that they are phanerogamic; yet they are as attractive to the bees as the gaudy peach blooms. A few days ago I visited the Sydney Botanic Gardens. At the time of my visit the most attractive beds of flowers were daisies, pansies, anemones, and the turban ranunculus. Nothing in the Gardens was more showy than these latter, yet no bee visited them. Near was a shrub (*Buxus simpervirens*) in which there was a constant hum. What was the cause? Hidden among the foliage there were some small greenish flowers, supplying abundance of bee food. If colour had been their guiding star they would never have found it in the shrub—they would have searched the ranunculus beds; and there they would have searched in vain. But who will say the attractive *colour* was not there?

When I found the bees had forsaken the Arum lilies and broad-beans for the peach and willow-trees, I tried to induce them to return to the first-named by offering them large bribes. I covered the essential organs of the lily with pure honey; but no bee visited them, and finally the bribe was carried away by ants.

It is more than doubtful if bees are attracted to flowers by their colours. Bees can distinguish colours and objects. The tests supplied by Sir John Lubbock on this point are interesting; but do not go to show that the bees are attracted by the colours in flowers. He says "bees have played a very important part in the development of flowers." (*Read the whole quotation above*). "I thought," he says, "it would be desirable to prove this, if possible, by actual fact. . . . . I brought a bee to some honey which I placed on blue paper, and about 3 feet off I placed a similar quantity of honey on orange paper." [*Note*, his experiments were carried out with paper covered with honey, not with flowers.] "The bee carried away a load of honey and returned to the same blue paper twice." He then transposed the papers, and she made three more visits to the same coloured paper. On the following day he again transposed the colours. The

bee "returned to the old place, and was just going to alight, but observing the change in colours, without a moment's hesitation darted off to the blue. No one who saw her at that moment could have entertained the slightest doubt about her perceiving the difference between the two colours." Yes; because she had learned it was the blue paper that gave her food. The bee was working by sight, exactly upon the same lines as the highly intellectual man acts. If there be two cupboards or safes of two different colours in a room—a blue one containing his food, and an orange one his papers—if their positions are frequently changed he goes into the room and looks for the one, by its colour, that contains the food or papers he may require; but if he had been accustomed to find the blue safe in the room in the same position, he would enter the room and would be about to open it, " but observing the change of colours, without a moment's hesitation" he too would "dart off to the blue," and " no one who saw him at that moment could entertain the slightest doubt about his perceiving the difference between the two colours" of the safes. It was not the colour that attracted the bee; it was the food. Notwithstanding the transpositions of colour, as soon as all the honey had been used up, the orange or any other colour would have been just as attractive if bee food were placed on it.

On one occasion I saw a bunch of flowers that had been brought from a distance thrown out on a rubbish heap. It was early spring, and at the time bee food was very scarce, especially pollen. There was a good store of honey within the hives; there was also young brood; therefore, pollen was needed. As soon as the bees saw these discarded blooms many of them were " just going to alight," but observing there was no food they hastened off to the inconspicuous flowers of the couch grass, upon which they had been at work for several days, because there was nothing else at that time supplying them with pollen that was so essential for the young brood.

In " *The Story of the Plants*," Grant Allen says, "The use of the corolla, with its brilliant coloured petals, is to attract insects to the flowers and induce them to carry pollen from plant to plant. That is why they are painted red and blue and yellow; they are there as advertisements to tell the bee or butterfly 'Here you can get good honey!' If the brilliant coloured petals of flowers are so attractive to bees, how is it that single blooms are more attractive to them than double ones of the same variety, and having the same colour? The single ones produces pollen food, but the double ones do not. The food is its own advertisement, not the coloured petals.

(*To be continued.*)

Bee Calendar.

ALBERT GALE.

NOVEMBER.

THE most necessary traits in the character of all bee-keepers to ensure success are kindness and gentleness, and these powers will require full exercise this month. Physically a bee-keeper requires a pair of good eyes that have been trained to keen observation, and a pair of sensitive ears that are quick to detect the various changes in the sounds that are emitted by bees. They readily inform us of their likes and dislikes. They have a language that is easily translated by bee-keepers of experience, who act according to the requirements indicated. " Watch and listen" is a motto to be kept constantly in view by all engaged in the bee industry.

This month "from the centre all round to the sea," bees will seize every favourable day to swarm if so prepared. Spring food has been fairly abundant all over the Colony so far, and the prospects for a large honey flow are very encouraging. Act upon the principle of strong swarms and quick returns. Where it is not desirable to increase the apiary, check all swarming. There are several ways of so doing. Examining the frames of brood about every fourteen days, and removing all queen cells is one of the best. If the swarms come out, kill one of the queens; of course, keep the best. Search the hive the swarm issued from, and compare the queen left behind with the one on the wing. The former may not have emerged from the cell, or she may not have mated, and in other ways may not be a "tested queen." On the other hand the one on the wing may possess all good qualities; but, if it be the first swarm of the season it will be an old queen, at the least a last season's one, and if her age be not known she should be superseded by a young tested one. I am presuming there are a few tested queens kept in stock at this season of year. As soon as the swarm has alighted shake them in the usual way, and when they have fairly settled, place them close to the parent hive. Having selected your queen, return the swarm from whence it came, and next morning the combined swarm will set to work equal to a virgin colony. If you wish to make any alteration in the position of your hives now is your chance. Having put in the new swarm successfully, remove the parent hive to the new position required. On the following day, when the united bees issue to work, not 1 per cent. will return to the former position. The old stock, with the swarm, should be removed to the new position on the evening of the same day the swarm issued forth.

See that there is plenty of room in the brood-chamber for increase. Don't let new swarms hang out in the sun. When hived see that they are well shaded. Give plenty of ventilation. There will be honey to extract. As far as possible keep the various flavoured honeys separate; it will make a deal of difference in the commercial returns.

Orchard Notes for November.

GEO. WATERS,
Orchard Manager, Hawkesbury Agricultural College.

In an orchard, every month might be termed the busy one; but this one especially is when "the time for everything and everything at its proper time" can be very aptly used. Now is the time to get at fruit thinning, and this is an operation that cannot be put off from week to week; for if the fruit is allowed to go past a certain stage, the time spent upon the operation is only wasted. The proper time is just as the stone is hardening, for at this stage the natural thinning or dropping is over, so that you can fairly allow that all those that are left on will stay there. Japan plums, apricots, and some varieties of peaches and nectarines are liable to overbear; in fact, with the first mentioned it is one of their few faults. This thinning of fruit is not in its initiatory stage, but it has been proved conclusively that it will amply repay doing so; and if our growers would only make a start it would soon be beyond the experimental stage in our Colony. Many very useful and paying "points" have been received from the fruit-growers of California, and in reading over a recent report of the State Board of Horticulture, I noticed that the peach growers are unanimous in their report of the successful results from fruit-thinning. Most growers usually remark that it does not pay to employ labour to thin; but there is no doubt that if one and all would make a start it would reduce the quantity of small rubbish that finds its way to the Sydney market. If every grower would only do even a few dozens of trees and watch the results, being careful they are compared with trees of the same variety, it would then give an idea of cost and result.

When thinning, growers must be careful in selecting those to pull and those to leave. If the variety has the habit of bearing its fruit in pairs, do not pull one and leave the other, else almost assuredly it will fall also. It is better to thin, say, alternate pairs. Many times the variety is a bad one, and will not be much benefited by thinning, in which case put a mark on it, and do not forget to bud if possible, or else graft next spring with something which will return some money. No doubt a lot of fruit-thinning is saved by judicious pruning in the winter.

In addition to those fruits mentioned, some of the large-fruited English plums are benefited by thinning, such as Pond's Seedling, Yellow Egg or Magnum Bonum, and in some districts Coe's Golden Drop. Some varieties of apples and pears may be so treated; though with apples the codling moth gives an unwelcome thinning. At the end of the month the first batch of codling moth grubs will be reaching maturity, at which time many of the apples will fall; so it is best to delay the thinning of them till then. Pears can also be left till the latter end of the month. The bands for placing round the trunks of the trees should be prepared and placed on as soon as

possible. All fallen fruit that may have grubs in them should be destroyed, and any available harbour in the shape of rubbish, &c., in the orchard cleared away.

During the month, keep the orchard well cultivated, especially if the weather be dry; stir the ground, do not turn it, and it will thus retain the moisture. Keep all weeds down, as they only form harbours for insects, and it certainly does not pay to grow weeds. Examine orange and lemon trees for traces of the orange rust mite or Maori, and, as noted last month, if they appear, spray with the sulphur and soft soap, or dust with sulphur. Red and black scales should be watched, and the trees sprayed with kerosene emulsion wherever they are attacked.

In places where peach freckle was prevalent, a second spraying with Bordeaux mixture (summer solution) should be applied now, doing the work early in the morning or late in the afternoon when the sun is not too powerful. The summer solution is about half as strong as the winter one, the proportions being 6 lb. bluestone, 4 lb. of quick-lime, and 40 gallons water. If the season is dry, and water is available by irrigation, the trees would benefit by a good application now. Give a good watering, but not too much, and stir the ground well by cultivators as soon after as possible, and so retain the water that you have applied.

Practical Vegetable and Flower Growing.

Directions for the Month of November.

Vegetables.

If the directions which are published month after month in the *Agricultural Gazette* have been followed, there should be no want of a great variety of vegetables during November, in every district and climate in the Colony, provided that there has been a sufficient rainfall, or that there is plenty of water available for irrigation.

Although some vegetables, such as the cabbage and others having great leaf surface, require and evaporate large quantities of water, it is not a wise thing to overwater, for if this be done the produce will be of much the same undesirable quality as the watery insipid vegetables raised by Chinese.

At the Bathurst Experimental Farm last year a large number of vegetables of different kinds were raised without irrigation, or much, if any, watering. The demand by the public for these vegetables was surprising, as they were of far better quality than the vegetables grown by the Chinese in the vicinity, and very much preferred to them.

Good cultivation has a marked effect on plants of all kinds, and it may be particularly observed in vegetables.

Weeds of very many kinds will make vigorous headway during the summer unless they be destroyed in their early growth. The use of farmyard manure in an insufficiently decayed or rotted state is likely to cause the spread of various weeds, for their seeds pass through cattle, sheep, and horses without having their vitality injured.

For other reasons, farmyard manure, well rotted, without waste, is far better for vegetables than if it be applied to the soil in a fresh and rank condition. Depend upon it, it is worth while to take the trouble to look after your manure, and apply it in the condition that is most likely to be most advantageous.

Beans, French or Kidney.—Plants raised in the warmest parts of the Colony might be expected to produce pods sufficiently large for use. Young beans are far more tender and better for use than those which have grown old, and have become hard and stringy. Keep the ground well worked between the rows, and use a Dutch hoe or a hand Planet Junior hoe, which is a useful tool for many garden purposes. If the season is very dry, spread over the ground a thick dressing, usually known as a mulch, of farmyard manure, dead leaves, dead grass, sea-weed, dry fern, or anything similar convenient that is likely to prevent evaporation. This may save the plants from dying, perhaps, if there be no water available with which to give them a soaking. It may be stated that the French bean thrives best in a somewhat moist soil if well drained. If water be plentiful give the plants a thoroughly good soaking, but only occasionally. Seeds of the dwarf, the runner, the scarlet runner, the snake bean, and varieties of butter bean may

be sown in all parts of the Colony except those where frosts may be expected to occur. Sow the seeds in rows, and cover them with not more than 3 or 4 inches of soil. The plants should stand from 6 to 8 inches apart in the rows.

Beet, Red.—Dig up well some land which is either naturally rich or which had been heavily manured for a previous crop of (say) cabbage or some other vegetable. Manure freshly applied is liable to spoil the shape of the roots and make them fork and, therefore, become objectionable for cooking. A few plants raised from time to time will probably meet all demands.

Beet, Silver.—Is grown for its leaves only, and not its root, consequently it will be improved by the land being well manured. Sow a little for transplanting when the seedlings are large enough. Plant out from previous sowings, if any were made, all the young plants in proper condition.

Broccoli.—If any young plants are ready in the seed-bed plant some out to rich well-manured soil. Sow a little more seed.

Cabbage.—Sow sufficient seed to keep up a continuous supply of young plants. Plant out from the seed-bed a few strong young plants to some rich land, which if not naturally very rich should be made so with farmyard manure. A good watering with liquid manure made from animal droppings will improve growing cabbages. Cultivate the ground frequently between the plants.

Carrot.—Sow some seed in drills, which should be made from 12 to 18 inches apart. When the seed comes up, thin out the seedlings and do not let them crowd one another. It is better not to manure directly for the carrots when preparing the ground.

Cauliflower.—Sow a little seed either in seed-bed or box where it can be well attended to, watered, and shaded.

Celery.—Sow a very little seed in a seed-pan, pot, or box. If any plants are available and large enough, plant them out in well-prepared ground that has been made very rich. The usual plan for planting celery is to make shallow trenches and plant along the bottoms. These trenches facilitate watering, and it must be kept in mind that plenty of moisture and plenty of liquid manure are almost absolutely necessary for the production of first-class celery. It should be the aim of every grower to cultivate celery of the best quality, for the poor stringy miserable stalks generally sold as celery cannot be compared for one moment with well-grown, nutty-flavoured, tender leaf-stalks, which are but seldom met with.

Cucumber.—Sow seed in ground that has been well prepared by deep digging or trenching and heavy manuring, if the soil is not very rich. Plants that are growing and spreading over the ground should have the ends of the shoots pinched to induce the growth of lateral or side branches.

Cress and Mustard.—Sow a yard or two of ground with seed of these two useful salad plants. The plants will need a good deal of water during hot, dry weather.

Egg Plant.—Plants raised from seed sown in the early spring should be ready to plant out in the garden. Let them stand about 3 feet apart from each other when planted. Seed may be sown if any more plants are required. Some of the varieties are very ornamental when bearing their remarkable fruits, and may be planted in the flower-garden with effect.

Leek.—Sow a little seed in a seed-bed so as to have some plants on hand if required. The leek needs rich feeding, and is one of the greediest of

vegetables. It also needs good supplies of water. Plant out a few young leeks, and plant them deep in the soil. Well-grown plants should be earthed up to blanch their stems.

Lettuce.—At this time of year and during the summer the lettuce is rather difficult to grow well, as it has a great tendency to produce flowers and seed. To prevent this make the soil rich and keep the plants growing quickly with careful watering and the application of liquid manure.

Maize, Sweet.—Sow in rows about 4 feet apart, and 1 foot apart in the rows. Cultivate well when the plants come up, and keep on cultivating as long as possible. Do not draw up the soil to the plants, but cultivate on the flat.

Melons.—Sow a few seeds, and treat the plants as recommended for cucumbers.

Okra or Gumbo.—Plant out a few seedlings if they have been raised, or sow a little seed. The soft green pods are used in soups and stews.

Onion.—Sow a little seed, and attend to onions which are growing and keep them free from weeds. Sprinkle over the onion-beds a mixture of half soot and half salt, which makes a useful stimulant, and is to some extent a preventive of the attacks of insects on the plants.

Peas.—Sow a few rows in the cool climates.

Pepper, Chilli or Capsicum.—Plant out a few seedlings. If no plants have been raised sow a little seed.

Potatoes.—Plant a few rows with clean, whole, medium-sized potatoes. Avoid all that show signs of potato-scab or potato-moth.

Pumpkins.—Sow seed in well-manured or rich soil. Pinch back runners, in order to keep the plants compact.

Radish.—Sow a little seed from time to time, and use the plants as soon as they are large enough and whilst they are quite tender.

Rhubarb.—Sow a little seed if plants are required for planting during the next winter or early spring. This is a most useful plant to grow, and no garden should be without a supply.

Sweet Potatoes thrive best in warm sandy loam, but they will succeed fairly well in other kinds of soil, with the exception of cold heavy clay. Plant tubers in a warm place, where they can start into growth soon. When the shoots have grown well, take cuttings and plant in beds well prepared for them, where they can root. The tubers will readily start into growth if they be laid out on a warm bed, and covered about an inch or two with rotted stable dung kept rather moist. The cuttings, when well rooted, should be planted out in rows, the rows being 4 feet apart. Plant the rooted-cuttings 1 foot apart in the rows. Raise the vines occasionally as they grow, to prevent their rooting at the joints.

Spinach.—Sow a very little seed.

Tomato.—Seed may be sown in any quantity at this time of year if required. Young seedling tomatoes may be planted out, and those already growing which have attained some size should be supported by stakes or on trellisses, or in any way the ingenuity of the grower can devise, to keep the plants from trailling over the ground. Any fruit that may appear diseased, and which shows signs of the well-known black or the greenish looking blotches, should be destroyed by fire.

Turnips.—Sow a little seed in drills.

Vegetable Marrow and Squash.—Sow a little seed, and treat as recommended for cucumber.

Flowers.

The work in the flower-garden will be chiefly routine, such as the keeping weeds down, trimming up hedges and edgings, and making the garden-walks free from weeds and tidy.

Roses will now be in great perfection, and the best of them will blossom during this month. When the flowers fall off prune back the shoots on which they were growing to a good wood-bud, and fresh wood will be the result, and this fresh wood will bear more flowers. After pruning back, give each plant a gallon or two of liquid manure. If there are pigs on the farm, or if pigdung can be obtained, make the liquid manure of some of it mixed well up in water.

Bulbs of many sorts will be in full bloom during this month. The splendid hippeastrums should be particularly conspicuous. They are no trouble to manage, and if anyone desires to grow them bulbs can be obtained during the winter from plant nurserymen. Let the leaves of bulbs wither away, and never pull or cut them off, for they are needed to collect and elaborate material which, as the leaves fade away, is stored up in the bulbs for use next season.

Plant out dahlias of all kinds, not all at once, but a few now and then, so as to keep up a succession of flowers. Try single cactus as well as the double varieties, and grow only one stem to each tuber. It is more than probable that several shoots will come up. If so, break off all but one. Knock into the ground a strong stake alongside each tuber, when planting, and as the stems grow tie them carefully to the stakes, or else the plants may be blown down from being naturally very top-heavy.

Plant out balsams and all sorts of tender annuals from the seed-beds, or wherever they have been raised.

General Notes.

Coffee-growing.

The following note has been submitted by Mr. C. Skelton, who recently visited the northern districts to report on the prospects of coffee-growing:—

Since my article on coffee-growing appeared in the *Agricultural Gazette* for January last, I have, at the instance of the Minister for Mines and Agriculture, inspected the Clarence, Richmond, and Tweed Rivers districts, with a view to ascertaining their capabilities for the production of coffee. In all three districts I saw large tracts of land, cleared and uncleared, well suited for the purpose; soil and climate are all that could be wished for, as also are the specimens of coffee trees I saw growing in the different districts, strong, healthy, well-grown trees; in many instances, at the time of my visit, laden with crops. With the wonderful fertility of the soil and the general suitability of those parts of the Colony for the purpose, it is surprising that the industry has not progressed beyond the experimental stage; for, with the exception of a small plantation of 800 or 900 trees made by Mr. Bale, at Chatsworth Island on the Clarence River, and groups of two or three trees in gardens in the different districts, coffee, to any appreciable extent, has not been tried.

As full directions are given in the article above mentioned for the preparation of the land, forming nurseries, and planting out, there is no occasion to repeat them, I would however suggest that where the land is forest and has to be cleared, it should be made a condition in the felling contract that all the branches be lopped and laid flat; a much cleaner burn will thereby be secured. I have been informed that in these colonies it is not the practice to do this, but in Ceylon it was always considered a necessity, in order to effect a fair "burn." In the northern rivers districts, I learned the usual rates for felling are from £1 to £1 2s. 6d. per acre; lopping will probably cost 10s. an acre more, but it will be found after the fire to be 10s. well expended, as it will, to a very great extent, do away with the usual piling and clearing up after the fire. To attain the same end, always set fire to the *lee* side of the clearing, and let it burn up against the wind; it will burn more slowly, but more effectively.

The conditions for planting here being somewhat different from India and Ceylon, where cheap coolie labour is obtainable, I believe it would be an advantage to set out the coffee trees wider apart than 6 feet, as formerly stated; say, 7 feet by 7 feet, or even a foot more; this would admit of the use of a one-horse light scarifier between them to keep the ground clear of weeds; it must be a very light scarifier, as the roots of the coffee are very near the surface. This space would also allow of the passage of some sort of vehicle to pick up the bags of cherry coffee in crop-picking time for transport to the curing works. With the exception of planting and pruning, which latter commences after the second crop has been gathered, nearly the

whole of the work on a coffee plantation may be effected by contract, provided there is careful supervision to prevent the work being slummed over; even crop-picking may be let out at so much per bushel of cherry coffee. This latter is essentially women's work; a good picking woman will pick twice as much as almost any man, her fingers are so much more nimble.

Curing the crop, if the plantation is on a small scale—say, under 5 acres—may be effected by tramping out the cherry coffee on a plank floor with bare feet; heap it up so as to cause fermentation, which will ensue in about twelve hours, more or less, according to the size of the heap and the temperature. It will be found that the glutinous matter which adheres to the bean can then be washed off; put in tubs or half casks; and wash thoroughly with plenty of water, separating the beans from the pulp, allowing the latter to run off with water. When all the viscous matter has been removed, and the beans feel clean to the touch, spread them out in the sun on any sort of matting that is available, let them remain in the sun till so dry that when the parchment and silver skins are rubbed off, you can only just mark the bean with your thumb nail, or till the coffee is dried down to 25 lb. or 24 lb. to the bushel; it is now in a state to bear carriage to any part of the world; but before being put into the market it has still to go through a process called "hulling and sizing," that is, removing the parchment and silver skins, and grading the beans into three sizes to facilitate uniform roasting; however, this last process the planter has nothing to do with, as it is now generally done on arrival in Europe.

Where the plantation is a considerable one, and pulping machinery, fermenting and washing cisterns, &c., have to be employed in the curing of the crop, it is scarcely possible to give directions that could be successfully carried out by a novice. When it is taken into consideration that in Ceylon, no man was deemed fit to take charge of a plantation until he had served for at least three years under an experienced planter, it will be understood there is a good deal to learn, and the proper conduct of curing operations is by no means the least part of it. The variations in the prices of coffee in the European markets—as much as 30 per cent. and even more—are almost wholly due to the manner in which the curing of the different parcels has been carried out. It was principally for this reason, that in my report to the Minister, I suggested the opening of two demonstrative plantations by the Department of Agriculture, as object lessons to intending planters in the districts referred to. I can see no other way, with any hope of success, of imparting the requisite information.

Agricultural Depression in Great Britain.

Report of the Royal Commission.

The report of the Royal Commission on agricultural depression is now completed. It is a document of great length, dealing with various phases of the question and suggesting remedies for evils shown to exist. The Commissioners are clear that the main cause of the depression is the heavy fall in the prices of agricultural produce. On this point they have arrived at the following general conclusions:—

(*a*) That the changes in the prices of grain during the past twenty years represent a fall of over 40 per cent. in the three staple cereals, and over 50 per cent. in the case of wheat.

(*b*) That in the price of beef there has been in the same period a fall ranging from 24 to 40 per cent. according to quality.

(*c*) That the prices realised for mutton since 1882–84 have exhibited a progressive decline of from 20 to 30 per cent.

(*d*) That there has been a fall in the price of wool amounting to upwards of 50 per cent. during the past twenty years.

(*e*) That dairy produce has participated in this depreciation, and that, taking the changes in the prices of milk, butter, and cheese as a whole, there has been a fall approaching 30 per cent.

(*f*) That the fall in the staple products, already referred to, has been accompanied by a decline of at least 20 to 30 per cent. in the price of potatoes.

(*g*) That although there have been fluctuations in the prices of hops, they have exhibited in recent years a general tendency to fall to an unprofitable level.

The subject of dairying is dealt with rather briefly. The Commissioners hold that the system of co-operative dairying, as carried on in Denmark and in some parts of Ireland, might be advantageously extended in Great Britain. They say, *inter alia*:—It is clear from the evidence of witnesses that the effects of agricultural depression upon the dairying industry have been much less marked than in the case of the other branches of agriculture, although the trade in manufactured dairy-produce has been considerably affected during the past ten years by the increasing competition from foreign countries, and several witnesses have complained of the recent fall in the price of milk. It is generally agreed that foreign butter, owing to its greater uniformity in quality, colour, and texture, has materially displaced the home manufactured product. In order to ameliorate the condition of the dairy industry in this kingdom it is necessary to improve the manufacture of the produce, and especially to ensure a supply of uniform quality and appearance, so that it may be able to compete on at all events an equal footing with foreign produce. It appears to us requisite to extend the system of co-operative creameries and factories, and further to encourage in every way the diffusion of sound information upon the whole subject of dairying, including the selection of suitable animals, their food and general management, and every detail in connection with the production of butter and cheese. It is evident that it is most essential that greater attention should be paid to the selection of breeds and of animals adapted for the economical production of milk, both as regards quality and quantity. It is, in our opinion, most desirable that the system of keeping milking records should be more generally adopted, to show dairy farmers the relative value of certain breeds, as well as of individual cows in their herds. Also that the milk from each cow should be periodically tested to ascertain its value for butter-making purposes.

The feeding of milch cows is another subject requiring considerable improvement, and especially feeding in the winter months. As a rule, dairy cows are fed according to the various ideas of farmers, or according to the food there may happen to be upon the farm, and not upon definite or scientific principles, and it frequently happens that cows receive a good deal more food than is absolutely necessary, or food that is not calculated for the production of milk rich in butter-fat. In Denmark the creamery societies make regulations for the feeding and management of cattle in order to ensure uniformity of quality and the absence of unpleasant flavourings from particular kinds of food, together with a steady supply of milk in winter. It has been strongly urged in the evidence before us that there is a necessity

for the most scrupulous cleanliness in connection with cow-sheds, and al[l] buildings used for cows, and dairies, their fittings, utensils, and transport cans. It is clear from the evidence before us that in some cases the buildings used for cows and the surroundings are in an unclean and insanitary condition, and that insufficient care is taken to keep the dairies perfectly clean. In the co-operative dairies in Denmark cleanliness is enforced by stringent regulations to ensure the supply of sweet pure milk, and to prevent the spread of infectious disease by dairy products.

The Commissioners express themselves in favour of selling cattle by live weight, and hold that skilled correspondents, both at home and abroad, should be appointed to report to the Board of Agriculture on all matters affecting agriculture in their respective localities. They also declare that more attention and encouragement should be given to agricultural education.

The Dairy.

Bottled Bacteria.

Is there not a danger lest the new craze for pure cultures in the dairy and "nitragin" as an inoculant of the soil may bring the true principles upon which these materials are produced into disrepute? The large party who recently visited Denmark and Sweden had certain opportunities afforded them of seeing that method adopted in two or three important butter factories in which the pure culture—shall we call it Lacteria?—is employed. If it is admitted in so many words that the quality of butter as denoted by its flavour is owing to the action of certain organisms usually described under the generic term "bacteria," then it is evident that their presence is necessary in the cream from which butter is to be produced. If, on the other hand, it is admitted that inferior flavours of butter are owing to organisms of an equally specific character, it is equally clear that their presence is undesirable, and that steps should be taken to remove them or to neutralise their action. Those who have been instrumental in placing pure cultures upon the market claim that by their aid good results—if not the best—can be obtained, assuming that the management is in every respect satisfactory; but, while admitting the value of the principle at stake, there is no evidence to show that "bottled bacteria" are in any sense of the word necessary to the accomplishment of satisfactory results. Those among us who take the trouble to read or to see what has been accomplished, and still more what has been attempted, can scarcely fail to recognise one fact—that there is considerable mystification in connection with this new science of bacteriology, not, indeed, where principles are concerned, but where results are somewhat contradictory of principles, where skilled experimenters fail to agree among themselves, and where those who are unskilled and perhaps mere practitioners of to-day advance theories which have no support in practice, but which are here and there adopted and interwoven with the threads of recognised fact by both teachers and students who have no means of separating the real from the unreal. Nothing in these remarks shall be said, in the slightest sense of the word, disrespectful of the science of bacteriology, but I would respectfully urge upon all students of dairy science the importance of leaving well alone until it has been shown definitely that it can be bettered, of sticking to the form of practice which has been, and which still is, so successful, leaving Dr. Conn and his friends in the States to fight their own battles, and regarding the bottled bacteria of Germany and Denmark as the ingenious product of those business men who—as students of Nature—know only too well that they will be certain to find buyers.

Butter-makers in this country have long been taught that the production of a high-class article is a matter of great simplicity, and it would be a thousand pities to attempt to disturb either their practice or their belief. If a dairy produces systematically bad butter, the modern expert—almost without a second thought—concludes that want of cleanliness is the cause; he inquires as to the water supply, for fine butter cannot be made with utensils which are cleansed with impure water; he examines these utensils, from the milk pail to the churn; he satisfies himself that the dairy is well lighted and ventilated, and in the end he recommends, if that apartment is adapted for the work which has been performed in it as regards its structure, that it should be cleared out bag and baggage, the walls and ceilings thoroughly lime-washed, the windows and their frames, the doors and the floors thoroughly purified with boiling water, and the drains, if any open into the dairy, completely closed, so that purity reigns supreme. Into a dairy apartment thus cleansed the utensils and other appurtenances are returned after an equally thorough purification. The milk brought from cattle standing in a clean cow-house and milked in clean pails by clean hands is then separated, the cream ripened under well-recognised conditions, and the butter is produced. Now, I would ask who, with experience in matters of this kind, will deny that after such a metamorphosis difficulties will not be at an end? As a precautionary measure it would not be unwise to add to the first cream separated for churning, not a pure culture of lacteria, but a small quantity of butter-milk obtained from the last churning, and that a very recent one, in the best dairy within reach, a dairy in which the finest butter is produced. But in my experience, and doubtless in that of many others, even this precaution is seldom necessary, and I am quite satisfied that results are obtainable in this way which are all that can be desired, if not, indeed, all that can be accomplished.

There is the danger that in relying upon the systematic employment of pure cultures we may neglect the most essential of all conditions—perfect cleanliness. It is far more important to purify the dairy from time to time, as has been suggested, than either to introduce a pure culture or starter, whether it be from the "bottle" or from the dairy of a successful neighbour. It may be pointed out by the other side that the scientifically-prepared starter is free from bacteria of an undesirable character, and where milk has been pasteurised before separation or the cream pasteurised after, and the pure culture is used, the ripened cream contains practically no other form of organism. This may be perfectly true, but we have to look at results, and if a thoroughly satisfactory result can be obtained with greater simplicity and with less cost, the practise is not likely to be changed by any suggestions which have no basis when they are put to the test. If the cream of the average dairy contains other organisms than those which assist the butter-maker, it must be admitted that their action is neutralised by what have sometimes been termed the friendly bacteria, and that while they are not to be ignored as minimising the importance of cleanliness, they are by no means to be feared. In Sweden there are no doubt numerous butter-makers who have adopted the new practice, but inquiry from the first dairy scientists of the country clearly shows that no advantage whatever is obtained; on the other hand, those who continue the old practice are not only perfectly satisfied with it as compared with the new, but they are producing an article which it is practically impossible to improve upon for the English market, although in passing I may suggest that Scandinavian butter, in whichever way it may be produced, is not to be regarded from the British point of view as equal to the finest fresh butter.

Managers of factories and owners of large dairies in this country will do well to recognise the modern arrangement and equipment of the best Scandinavian factories. Since my last visit to Sweden a few years ago very great changes have taken place, and in every instance in which factories were visited during the recent Conference excursion the system adopted was the same. The most perfect in every sense of the word was the Hamra factory of the De Laval Separator Company of Stockholm. No doubt it is a show factory as well as a dairy intended for economical practice, but its equipment is beyond praise; briefly, after weighing, the milk is passed into large receivers, and from these into pasteurisers, which it leaves hot for the separator. The skimmed milk is cooled and passed into a receptacle in which it can be slightly heated, when the starter is added and maintained at a specified temperature for churning. The churn adopted has no lid, the butter revolving within and the whole work being performed in sight of the operator. It is 3½ feet in diameter, the rim is covered with a flange, while the beater consists of two arms, each of which possesses five fingers, while above these are two other arms of white enamel arranged so as to keep the cream down while the churn is revolving. In some other factories the milk is pasteurised before entrance into the separator during part of the year, and heated only to 101° F. during the remaining part—spring and summer—while in one or two cases also butter is washed on the British system. There was practically nothing shown which was repugnant to the British butter-maker; for objectionable—to use a much milder term—as the practice of employing the hand appears to be, the great cleanliness observed on the part of the dairymaids, and the spotless purity and suitability of their garments, largely minimised any feeling that was entertained. There may be more than one opinion expressed as to the desirability of the pasteurisation of the milk before separation, but there are good reasons for it, and among them—although this was not mentioned to the writer—is the fact that where mixed milks are churned, these milks coming from a considerable number of farmers, there is always some risk, even where inspection of the cattle is regular, of communicating an undesirable flavour to the butter, owing, it may be, to some temporary uncleanliness or accidental cause. In a private dairy where perfect cleanliness is maintained, and where the work is under the daily supervision of those who are always upon the look-out for any fault, it is doubtful whether the pasteuriser is a necessary part of the plant, unless it be for the purpose of preserving the skimmed milk during the hot months of summer.—JAS. LONG—*Agricultural Gazette* (Eng.)

CRACKED CORN FOR LAYING HENS.

I HAVE had some experience in feeding whole corn, both to growing chicks and laying hens, but have never fully succeeded. One of the secrets in making hens lay is to compel them to work for their living. Such is difficult when corn is used, for it requires only a comparatively few kernels to satisfy a hen's appetite, and hence she has no further need for activity.

I have fed some wheat and have always met with the best of success. The grain was generally scattered in some kind of litter, so that the fowls had to scratch for it. To this fact I ascribe the greater part of my success with wheat. As a general thing wheat is considered better for laying fowls than corn, but I think this result is largely due to the manner in which it is fed. It is difficult to scatter corn so as to keep the hens busy for any length of time. With wheat it is quite different, especially with the cheaper grade generally fed to poultry.

Working on this idea I have tried cracking corn and feeding much as I have used wheat. The first cracked corn was fed about the first of December, and I have continued it since with the best of success. So far as egg production is concerned it seems to be filling the bill exactly. I can recommend it to anyone wanting a cheap, practical food. Where wheat was from 40 to 50 cents. per bushel, cracked corn might not have been worth bothering with, but since the price of wheat has doubled it has put a different phase on the question.

An average kernel of corn cracked in three or four pieces seems to answer the purpose best. If it is cracked finer, there is apt to be considerable waste. The average farm feed-mill ought to grind the kernel to the required fineness. I have noticed that a round kernel cracks more satisfactorily than a flat one.—C. P. REYNOLDS—*American Agriculturist.*

Replies to Correspondents.

Drying Peaches for Home Use.

Mr. William Anderson, of East Kempsey, sends the following note on drying peaches for home use:—"Peel the peach. Cut it into about five pieces, cutting from the outside into the stone. Take a strong needle and a piece of cotton a yard and a half long (No. 16 sewing cotton will do), make a small slip-knot at the end of the cotton and thread the peaches on, putting the needle from the outside of the peach to the inside. Hang up the strings of fruit in a verandah, or where the wind and sun will get at them (I do not take mine in at night unless the weather is wet). Two or three days will dry the fruit, when it should be removed from the cotton, and placed, a few at a time, in the oven, being allowed to remain there till very hot, but not scorched or burned. Pack away in tins or some air-tight vessel till required for use."

Manures for Vegetable Plots.

Mr. C. W. Bowyer Smijth, of Hay, suggests that the Department should publish a table showing the manurial requirements of the various table vegetables, and the most economical method of applying artificial fertilisers.

The matter has been brought under the notice of the chemist, Mr. F. B. Guthrie, and he will prepare the necessary details for publication at an early date. It may be mentioned, however, that details of manuring the various vegetable crops are given from month to month in the vegetable notes.

Small Diseased Patches in Wheat Paddocks.

Mr. Dennis Murray, of Gunning, states that he has observed when he has sown seed-wheat that has all been carefully bluestoned, that, in reaping, patches of bunted heads are found in different parts of the paddock. He wants to know how this can be accounted for.

Dr. Cobb, to whom the query was referred, says that sometimes when the paddock has previously borne wheat the land becomes contaminated in spots, and in spite of bluestone the smut (bunt) will appear.

Candied Citron Peel.

Mr. E. H. Davis, of Ballina, writes:—"I wish to know how to manufacture candied citron peel. The citron grows well about here, and it would help me considerably if I knew how to treat the peel. I have tried experiments, but have not been successful."

The Fruit Expert, Mr. W. J. Allen, has furnished the following notes on the subject:—"Cut the peel into quarters lengthwise, remove the juicy portion, and throw the peel into a salt-and-water brine strong enough to float an egg, and allow it to remain in this for six days. Remove from this, and put into clean, cold water, and allow to stand for one hour. Then put into a copper preserving-pan, with as much fresh, cold water as will cover the peels, and let them boil until quite soft. As soon as a silver fork will go easily

into them they are for this stage boiled enough. Next place them on a sieve to drain them free from the water, and whilst they are draining make a syrup in the proportion of 1 lb. of loaf sugar to 1 quart of water. Allow this to boil until it forms a thin syrup, in which boil the peels until they look clear, which will take probably about thirty minutes. Some more sugar must now be boiled with only sufficient water for it to absorb. Make just enough of this to merely cover the peels when they are put into it. Again boil them, and continue to boil until the sugar begins to candy. They must then be taken out, and again drained. Before they are quite dry lay them out on large dishes, and shake a little very finely powdered sugar over them. Set the dishes in a warm place for the peels to dry. When dry they may be stored away for use. Be careful to keep stirring constantly while boiling, or the sugar will certainly burn. A wooden spoon is the best thing to stir with. For orange or lemon peel I would recommend cutting the peel into halves only."

Draining.

A CORRESPONDENT, in asking for some information about draining, says:—"I want to know the depth and the maximum fall to give water in various soils, and the best modes to work where one does not want to use pipes."

In reply, the Fruit Expert, Mr. W. J. Allen, states:—"I would not advise laying a drain that would have a less fall than 3 inches to every 100 feet. With a tile drain this will carry the water off fairly well. I prefer the tile drains, as they very seldom get out of order, and if they should happen to do so they are easily fixed. I know of drains in Canada which were put in twenty years ago, and they are good yet. However, where stones are available, a good drain may be made as follows:—Dig a ditch, carefully grading it at bottom; then place large flat stones at bottom, so as to form a clear passage of good size for the flow of the water. Fill the ditch then about half full with rough stones at bottom, and smaller ones towards the top, and on these a layer of sod, fine brush or hay; then fill the rest of the ditch with earth. I have seen drains such as the above, with a fall of 4 feet in every hundred, in both light and heavy soils, and they worked splendidly."

Pruning.

THE same correspondent states:—"I have pruned my trees both summer and winter very severely. Local residents advise me not to. My trees at present are well shaped, and carry plenty of fruit wood. Should I continue the double pruning or not?"

MR. ALLEN reports:—"The writer does not mention what sort of trees he has; but if this refers to deciduous trees, which are still making heavy growth, I would advise the two prunings still; but if they are fruiting, and in consequence only making a fair amount of young wood, I would give them only the one pruning, and that in winter. But by all means, now that the trees are in good shape, do not be persuaded by anyone to leave long, weak limbs, which would not have sufficient strength in them to hold a fair crop of fruit without bending down and exposing it to the sun, thereby burning and damaging it. If the trees are citrus, I would just keep them sufficiently open to allow the air to circulate freely, so that in hot weather the dry, hot winds can assist in destroying scale if there is any. Never prune a citrus tree in the fall or winter, but just before or while the tree is growing in spring or summer. By pruning in the fall or winter it exposes parts that have been shaded all summer, and if the winter is at all severe these parts, being tender, are easily injured by cold.

Drying Apples.

Mr. T. T. Wingfield, of Woodside, Tenterfield, asks for information about the process of drying apples, sulphuring, &c.

At page 712 of this issue, will be found some notes on the subject, by the Fruit Expert, Mr. W. J. Allen. and next month we hope to publish an exhaustive article on Fruit-drying by Mr. Allen.

Exhausted Sugar Lands.

Mr. E. H. Graves, of Koolool, Lismore, writing on the subject of sugar lands, says:—"A subject which, if it could be investigated, would be of great local interest, is why cane crops planted in virgin soil (and of course this also applies to older lands) will not grow the same weight of crop, nor with the same vigour, as in the past, although given more cultivation. The Manager of the Richmond River Experiment Farm, Mr. Geo. M. McKeown, to whom the communication was referred, says:—"The diminution of crops is caused by the failure to return to the soil by manuring, the plant-food removed by heavy crops of cane each successive year, there being no crop raised locally which taxes the land so severely as sugar. For growing crops a manure composed of one-third sulphate of potash, and two-thirds bone-dust is recommended, at a cost of about £2 5s. per acre per annum. When the old cane is ploughed out I would recommend subsoiling and sowing the land with cow peas at the rate of ½ bushel per acre broadcast, or 12 lb. per acre drilled; the crop to be ploughed in early enough to admit of decomposition before replanting the area with cane.

Vinegar-making, Extraction of Cream of Tartar, &c.

The report of the Viticultural Expert in reply to questions raised in the following letter from correspondents may prove of interest to our readers:—

"Will you kindly inform us how to make vinegar from grapes? We have some made from Black Hamburgh and Hermitage—the greater proportion Black Hamburgh. Last year it was quite good, so we racked it off and put it into two 5-gallon casks, and it has gone quite faint and 'winey.' Then we have a 40-gallon cask that was made by the person from whom we bought the property. It is a very 'winey' vinegar. If you could help us in this particular we should be very much obliged, as every season, on account of the February rains, we have a lot of waste grapes which we would like if possible to turn to profitable account. Also, if the *modus operandi* is not too complicated, we should like to know how the cream of tartar is extracted from grapes." "Is it possible to make a sweet wine without adding brandy?"

Concerning the first question, Mr. Blunno is now preparing an article on vinegar-making for the trade on a large or small scale. As to the extraction of cream of tartar, this is an industry that would have to be undertaken in a large way to be profitable. It would be necessary for a firm starting the manufacture of this article to collect all the lees of the wine, wine-stone, and grape-skins produced in the colonies to make the business pay. So far as the Department is aware there is not any firm engaged in the business in the colonies. The owner of a small vineyard would hardly find the extraction of cream of tartar profitable, but of course if there was a buyer the lees, wine-stone, and grape-skins could be turned to good account. Under the present circumstances, the best way of utilising these bye-products is to give them back to the vines, for which the lees, &c., are a complete and rich manure.

Re the last question, any sweet wine should contain 28 per cent. proof spirit at least to keep sweet. If the must be very sweet, say 32 per cent. of

sugar by a reliable saccharometer, the wine would contain 28 per cent. of proof spirit and also 4 or 5 per cent. of unfermented sugar, which would give it a sweet taste that would keep without any addition of brandy; but if the must had less than 29 or 30 per cent. of sugar, the wine would by degrees go dry sooner or later, according to the temperature of the cellar. There is no other honest way, but by fortifying with good brandy, to keep sweet a wine that would otherwise go dry. However, a sweet wine that has not been fortified may keep its sweet taste for six or seven months or longer, if kept in a cool cellar—the cooler the better—while a higher alcoholic strength of the wine will be in favour of the remainder of the sugar fermenting out more slowly. Say, for instance, a sweet wine with 25 per cent. proof spirit will keep sweet longer than the same wine, but with only 22 per cent. of proof spirit, all other conditions of temperature and treatment of the wine being equal.

System of Rotation for New England District.

Mr. W. Weir, of Craigdon, Armidale, asks for information about clearing land and the best system of rotation of crops for a cold district like his.

Mr. Geo. Valder, Principal, H.A. College, reports:—"In a cold district like that of New England, I would recommend adopting a system of rotation somewhat similar to that so successfully carried out in New Zealand, viz:—Feeding sheep on the land till it shows signs of 'wearing.' Then ploughing it up and sowing a cereal crop, either wheat, oats, or barley. The cereal crop can be continued for two years, or even more where the land is rich. Then put in a crop of either turnips or rape and feed it off with crossbred sheep. When putting in the turnips or rape, apply about 2 cwt. bone-dust, or superphosphate per acre. If the turnips or rape are sown in drills and cultivated between the drills, a better crop will result, and the land can easily be cleaned. When feeding off, if possible, give the sheep chaff in the field with the turnips and rape. The sheep will fatten better and the fertility of the land will be increased. After feeding off, plough up the land, and lay it down to permanent pasture such as mixed grasses and clover, or lucerne. Then feed again with sheep until the land shows signs of wearing and continue the same system.

CORRECTION.

Owing to a misunderstanding the article in September issue on Experiments conducted at Pennant Hills by Mr. W. C. M. OWEN for the treatment of Melanose was credited to "Mr. G. B. Owen, of Castle Hill." It is regretted that this error occurred, as Mr. W. C. M. Owen went to considerable trouble, and devoted a lot of attention to the important and satisfactory experiments described in the article.

AGRICULTURAL SOCIETIES' SHOWS, 1897.

Society.	Secretary.	Date.
Dapto A. and H. Society	A. B. Chippendall	Jan. 6, 7
Albion Park A. and H. Association	H. Fryer	,, 13, 14
Gosford A. and H. Association	W. McIntyre	,, 29, 30
Wollongong A. and H. Society	J. A. Beatson	Feb. 3, 4
Cobargo A., P., and H. Society	T. Kennedy	,, 16, 17
Ulladulla P. and A. Society	C. A. Cork	,, 16, 17
Berrigan A. and H. Society	R. Drummond	,, 17
Riverina P. and A. Society (Cereal)	W. Elliott	,, ——
Manning R. (Taree) A. and H. Association	H. Plummer	,, 18, 19
Lithgow A., H., and P. Society	J. Asher	,, 18, 19
Robertson Agricultural Society	R. J. Ferguson	Mar. 2, 3
Bega A., P., and H. Society	J. Underhill	,, 3, 4
Southern New England (Uralla) P. and A. Association	Jas. Leece	,, 9, 10
Tumbarumba P. and A. Society	W. Willans	,, 9, 10
Tenterfield Intercolonial P., A., and M. Society	F. W. Hoskin	,, 10, 11, 12
Coonabarabran P. and A. Association	E. May-Steers	,, 11
Oberon A., H., and P. Association	A. Gale	,, 11, 12
Berrima District (Moss Vale) A., H., and I. Society	J. Yeo	,, 11, 12, 13
Cobargo A., P., and H. Society	T. Kennedy	,, 16, 17
Crookwell P. and A. Association	W. P. Levey	,, 18, 19
Lismore A. and I. Society	T. M. Hewitt	,, 18, 19
Walcha P. and A.	F. Townsend	,, 23, 24
Cudal A. and P. Society	C. Schramme	,, 24, 25
Blayney A. and P. Association	J. Clements	April 1, 2
Mudgee A., P., H., and I. Association	J. Cox	,, 6, 7
Liverpool Plains (Tamworth) P., A., & H. Association	A. M'Leod	,, 6, 7, 8
Warialda P. and A. Association	W. B. Geddes	,, 7, 8
Williams River A. and H. Association	W. Bennett	,, 7, 8
Cooma P. and A. Society	D. C. Pearson	,, 7, 8
Orange A. and P. Association	W. Tanner	,, 7, 8, 9
Gulgong P. and A. Association	C. E. Hilton	,, 13, 14
Queanbeyan P. and A. Association	W. D. Wright	,, 13, 14
Royal Agricultural Society	F. Webster	,, 14-20
Moree P. and A. Society	S. L. Cohen	,, 21, 22
Clarence P. and A. Society (Grafton)	J. Wilcox	,, 27, 28
Bathurst P. and A. Society	W. G. Thompson	,, 28, 29, 30
Hunter River (West Maitland) A. and H. Association	W. C. Quinton	,, 28, 29, 30
Hay Hortic. Society	J. Johnston	May 5
Namoi P. and A. Association (Narrabri)	J. Riddle	,, 5, 6
Hawkesbury District Agricul. Association (Richmond)	C. S. Guest	,, 6, 7, 8
Upper Manning A. and H. Society	W. Dimond	,, 12, 13
Wellington P. and A. Society	R. Porter	,, 13, 14
Upper Hunter P. and A. (Muswellbrook)	J. C. Luscombe.	,, 19, 20, 21
Nyngan and District	E. H. Prince	June 1, 2
Brewarrina P. and A. Association	H. L. Cathie	,, 7, 8
Cobar P. and A. Association	W. Redford	,, 9, 10
Deniliquin P. and A. Society	H. J. Wooldridge	July 13, 14
Hay P. and A. Association	Chas. Hidgcock.	,, 22, 23
Riverina P. and A. Society (Jerilderie)	W. Elliott	,, 27, 28
Condobolin P. and A. Association	H. W. Grey Innes.	,, 28, 29
Lachlan P. and A. Association (Hillston)	Thos. Cadell	,, 30
Gunnedah P., A., and H. Association	J. H. King	Aug. 3, 4
Forbes P., A., and H. Association	F. Street	,, 5, 6
Corowa P., A., and H. Society	E. L. Archer	,, 19, 20
Cootamundra A., P., H., and I. Association	T. Williams	,, 25, 26
Grenfell P., A., H., and I. Association	G. Cousins	,, 25, 26
Northern Agricultural Association	C. Poppenhagen	Sept. 1, 2
Murrumbidgee P. and A. Association (Wagga)	P. W. Lorimer	,, 1, 2
Burrawong P. and A. Association (Young)	C. Wright	,, 1, 2
Manildra Agricultural Society (Ploughing Match and Horse Parade.)	G. W. Griffiths	,, 8

Society.	Secretary.	Date.
Albury and Border P., A., and H. Society	Geo. E. Mackay	Sept. 8, 9
Murrumburrah P., A., and I. Association	Miles Murphy...	„ 8, 9
Yass P. and A. Association	Thos. Bernard...	„ 9, 10
Wallsend and Plattsburg A. H. P. P. and C. Society	G. Gilmour	„ 9, 10, 11
Junee P., A., and I. Association	T. C. Humphrys	„ 15, 16
Burrowa P., A., and H. Association	J. H. Clifton	„ 16, 17
Cowra P., A., and H. Association	Fred. King	„ 22, 23
Temora P., A., H., and I. Association	W. H. Tubman.	„ 22, 23
Moama A. and P. Association	C. L. Blair	„ 29
Narrandera P. and A. Association	J. F. Willans	Oct. 6, 7
Berry Agricultural Association	A. J. Colley	Nov. 24, 25, 26
1898.		
Dapto A. and H. Society	A. B. Chippendall	Jan. 12, 13
Albion Park A. and H. Association	H. Fryer	„ 19, 20
Kiama A. Association	J. Somerville	„ 25, 26
Gosford, A. and H. Association	W. McIntyre	„ 28, 29
Alstonville Agricultural Society	H. R. Elvery	Feb. 1, 2
Wollongong A., H., and I. Association	J. A. Beatson	„ 2, 3
Robertson Agricultural Society	R. G. Ferguson..	„ 8, 9
Shoalhaven A. and H. Association	R. C. Leeming...	„ 10, 11
Manning River A. and H. Association (Taree)	H. Plummer	„ 10, 11
Moruya A. and P. Society	John Jeffery	„ 11, 12
Ulladulla A. and H. Association (Milton)	C. A. Cork	„ 16, 17
Kangaroo Valley A. and H. Association	W. Randall	„ 17, 18
Tumut A. and P. Association	B. Clayton	„ 26, 27
Southern New England P. and A. Association (Uralla)	J. D. Leece	Mar. 1, 2
Bega A., P., and H. Society	J. Underhill	„ 2, 3
Upper Hunter (Muswellbrook) P. and A. Association	J. C. Luscombe.	„ 2, 3, 4
Bombala Exhn. Society	R. H. Cook	„ 8, 9, 10
Tenterfield Intercolonial P., A., and M. Society	F. W. Hoskin...	„ 9, 10, 11
Cudal A. and P. Society	C. Schramme	„ 10, 11
Crookwell P. and A. Association	M. P. Levy	„ 10, 11
Inverell P. and A. Association	I. McGregor	„ 10, 11, 12
Berrima District (Moss Vale) A. H. and I. Society	J. Yeo	„ 10, 11, 12
Armidale and Glen Innes Combined New England District Show at Armidale.	J. Allingham	„ 16, 17, 18
Cumnock P. and A. Association	Thos. Howard...	„ 17
Blayney A. and P. Association	G. Pile, junr. (acting).	„ 17, 18
Goulburn A., P., and H. Society	J. J. Roberts	„ 17, 18
Walcha P. and A. Association	F. Townshend...	„ 22, 23
Namoi P., A., and H. Association	J. Riddle	„ 23, 24
Central Richmond (Coraki)	D. Cameron	„ 24, 25
Camden A., H., and I. Society	W. R. Cowper...	„ 23, 24, 25
Bathurst A., H., and P. Association	W. G. Thompson	„ 23, 24, 25
Liverpool Plains P. A. and H. Association (Tamworth)	A. C. M'Leod...	„ 29, 30, 31
Macleay A., H., and I. Association	J. M'Maugh	„ 30, 31, and April 1.
Mudgee Agricultural Society	J. M. Cox	April 14, 15
Orange A. and P. Association	W. Tanner, junr.	„ 30, 31, April 1
Molong A. and P. Association	P. F. A. Kinna..	April 5, 6
Warialda P. and A. Association	W. B. Geddes...	„ 6, 7
Royal Agricultural Society of N.S.W.	F. Webster	„ 6–12
Richmond River A., H., and P. Society (Casino)	Jas. T. Tandy...	„ 14, 15
Moree P. and A. Society	S. L. Cohen	„ 27, 28
Dubbo P. A. and H.	H. Munckton	„ 26, 27
Hunter River (Maitland)	W. C. Quinton	„ 27, 28, 29
Gunnedah P. and A. Association	J. H. King	May 10, 11
Hawkesbury District Agricultural Association	C. S. Guest	„ ——

Secretaries of Societies are asked to forward dates of forthcoming Shows as soon as decided.

[Three plates.]

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Further Notes on the Milling Qualities of different Varieties of Wheat.

BY F. B. GUTHRIE AND E. H. GURNEY.

THE batch of wheats which forms the subject of the present communication was harvested by Mr. W. Farrer, of Queanbeyan, early in the present year. This makes the fourth consecutive harvest of Mr. Farrer's which has been thus laid under contribution, and from which the most important and promising grain has been selected for examination. Those who wish to compare the results of this and previous harvests, and to go fully into the details of the method of examination adopted, are referred to the *Agricultural Gazette* of March, 1895.

It will be sufficient to say here that the method of milling is in all respects the same as in previous years, and the results are strictly comparable in all cases.

The present batch of wheats (harvested in December, 1896) had been, however, manured with bone-dust, and since this lot is especially rich in gluten, the treatment may have been to some extent responsible for the gluten increase, though it must be remembered that the year was a remarkably dry and sunny one.

Of the harvest of December, 1895, only four samples were examined, a number insufficient to be worth while publishing separately. Their results are therefore attached to those of the present year, and are presented in the following table:—

TABLE A.—HARVEST OF DECEMBER, 1895.

Variety of Grain.	Appearance of Grain.	Weight per bushel.	Milled Products. Flour.	Pollard.	Bran.	Colour.	Gluten.	Strength.	Milling Notes.
1. Bald Odessa..	....	64·2	75·0	13·5	11·5	B ₄	11·65	46·0	Easy to mill. 5 breaks, 5 reductions, 3 extra reductions, semolina white and soft, flour clings to bran, bran not clean, pollard clean.
2. Rousselin....	Medium size, medium hardness, mixed red and white berries.	..	75·0	14·5	10·5	D ..	13·58	45·0	Easy to mill. 5 breaks, 5 reductions, 2 extra reductions, flour has tendency to cling (especially in case of red berries), semolina faintly pink and slightly gritty, fair amount of flour from breaks, bran clean, pollard clean.
3. Majorica Carusa.	Plump reddish, medium hardness.	..	77·0	8·7	14·4	D	13·33	44·3	Easy to mill. 5 breaks, 5 reductions, 3 extra reductions, semolina slightly pink and gritty, bran and pollard clean.
4. Improved Fife x White Essex	Medium translucent, medium hardness.	..	73·0	13·3	13·7	C	10·68	56·8	Easy to mill. 5 breaks, 5 reductions, 2 extra reductions, flour clings to bran, fair amount of flour from breaks, semolina yellowish and gritty, bran not clean, pollard clean.

The harvest of this year, December, 1895, was an exceptionally poor one, and Mr. Farrer's experimental plots suffered in common with the rest of the Colony, consequently the amount of grain at our disposal was too small to allow of the weight per bushel being satisfactorily determined.

Bald Odessa had been examined the previous year (harvested December, 1894). The milling notes on this wheat are almost identical, the principal difference being an increased gluten-content in the flour of the 1895 harvest, though the flour was weaker and of not quite so good a colour as in the previous year. The grain was much heavier, owing probably to the 1894 sample being attacked by weevil.

Rousselin and Majorica Carusa are French wheats; their flours are somewhat similar, being of a bad colour and very weak, though fairly glutenous. The most interesting of the wheats examined is the cross-bred, which is an excellent milling wheat, as its parentage would lead one to expect. In gluten-content and colour of flour it stands midway between its parents. In strength it is lower than either; but if the few wheats of this particular harvest which have been examined afford any criterion of the whole, it would appear that the 1895 harvest gave a flour deficient in strength.

Notes to Table B (pp. 762 and 763).

In Table B are presented the results of the examination of a number of cross-bred wheats and sports, all of which were harvested by Mr. Farrer in December, 1896. The plots had all received a dressing of bone-dust before sowing. The year was an exceptionally dry and sunny one, both of which factors have doubtless influenced the milling quality of the grain, notably in the proportion of gluten in the flour, which is, on the whole, higher than in previous years.

The first four of these wheats are so-called "sports," as will be seen by the notes. The most remarkable of these is that called "Early Lambrigg," which is a sport from Blount's Lambrigg, and yields a flour of phenomenal strength, with a very high gluten-content, and by no means so bad a colour as usually accompanies such a percentage of gluten. It is an easy-milling wheat, though not so easy to mill as the original Blount's Lambrigg. If crossed with some wheat possessing the necessary qualities of weight, good colour, and yield of flour, the result should be almost the best obtainable for this particular district. Curiously, the original Blount's Lambrigg possesses just these characteristics in a marked degree.

The grain of the other sport of this variety—F (5)—is quite unlike that of either the parent variety or of Early Lambrigg.

If the behaviour of this grain on milling were the only guide we possessed as to the identity of a grain, I should be inclined to hazard the suggestion that Blount's Lambrigg itself is not properly fixed. The three samples previously examined in February, 1896, all behaved differently in the mill, and gave results which were by no means similar.

The Improved Fife sport, 14 A, has none of the strength of flour of the parent variety, and is an inferior grain.

The remaining cross-breds are of special interest in the evidence they afford of the transmission of milling qualities—a point that was examined with some care in the first batch (*Agricultural Gazette*, March, 1895).

Nos. 5, 6, 7, and 8 all have Steinwedel blood in them, and in spite of the fact that the other parent is in all cases a Fife wheat, the flours obtained from the offspring are all exceedingly weak, with adhesive, inelastic glutens. Steinwedel itself has not been examined, but Mr. Farrer tells me he has

hitherto regarded it as an early strain of Purple Straw. From the evidence afforded by its progeny, it would, however, appear to be a distinct variety, and a much poorer milling wheat than Purple Straw.

Nos. 9, 10, and 11 are crosses between Hornblende and Indian wheats. Of the Indian wheats here crossed, Indian D is the strongest and B the weakest by itself; and it will be seen that this order is maintained in the progeny. The yellow tinge due to Hornblende is present in all of them. Roma, the offspring of King's Jubilee, is of better colour and nearly equal strength, though the gluten-content is lower. These are all characteristics which one would expect from the behaviour of the parents.

In No. 13 the influence of Steinwedel blood in diminishing the strength of the flour is again well shown, Steinlee, one of its parents, being itself an offspring of Steinwedel. The large bran given by No. 13 is also characteristic of another variety (No. 5). This does not appear to be a constant characteristic, as King's Jubilee was not remarked as yielding a particularly large bran, nor do the other Steinwedel varieties. No. 14, of which the mother is almost identical with that of No. 13, while its father is King's Jubilee instead of Steinlee (=Steinwedel × King's Jubilee), evidently owes its great superiority over No. 13 to the absence of Steinwedel from its pedigree. Both these wheats, which contain Blount's Lambrigg, are easy-milling wheats.

The next three contain Sicilian Square-headed Red, and the influence of this variety is evident in the high gluten-content, and also in the rather yellow colour of their flours. These are all good milling wheats, being easy to mill, yielding plenty of flour of high strength and gluten-content; their only objection from the point of view of our millers being the somewhat yellow colour of the flour.

The last, No. 18, which contains (Mr. Farrer says) $\frac{6}{16}$ Rye blood, is not a hopeful cross. It is the weakest of all hitherto examined, and with very bad colour, the gluten being remarkably high. It cannot, however, be regarded as a wheat, but is a rye-wheat; and its flour may be valued by those who like rye-bread.

Notes to Table C (pp. 764 and 765).

Table C includes the remainder of the wheats selected for examination from the last (December, 1896) harvest. It embraces a number of Indian wheats.

Common Bladette and French Early White are French wheats. Like the French grain previously examined (February, 1896), the flours from these wheats are deficient in strength and of a bad colour from the Australian standpoint. They are only fair to mill. Common Bladette is considered to be one of the four best milling wheats of France.

Nonpareil is a favourite South Australian wheat, and I have been fortunate enough to be able to compare this grain with that of the same variety grown in the same season (last) in South Australia. This point will be discussed on another page.

White Lammas was also examined in 1895. This year's harvest has produced a higher gluten-content, which is true of all wheats, the strength remaining much the same. A larger percentage of flour was obtained on this occasion, which may be the reason of the slightly inferior colour, as well as of the strength not being greater.

The new Indian wheats examined present the characteristics we have come to associate with these grains, namely, a high weight per bushel, high

strength and gluten-content in the flour, with a more or less pronounced yellow tinge. In the mill they run from fair to rather difficult to mill, giving a fair but not usually a high percentage of flour. Bran generally not very clean. Semolina yellowish and gritty.

Vilmorin's Indian appears to be a variety with a highly glutenous grain, weight per bushel, colour, and strength of flour being sacrificed. This wheat, however, may not have had justice done it, as it was soaked too long in the water before milling. (See milling notes on this wheat.) Vilmorin's Indian is an interesting variety, because, although it came originally from India, it has lost, from having been grown in France since 1839, almost all the characteristic qualities of Indian wheats. Instead of being early, as all the varieties appear to be when they come from India, it is quite late; and is unlike the generality of Indian wheats in having very dark and glaucous foliage.

Indian-grown Wheats.

The four wheats in Table D, p. 766, were grown in India, Nos. 35 and 36 being sent to Mr. Farrer from Cawnpore, and 34 and 37 from Nagpore. The names and descriptions are as we received them. It will be noticed that No. 35 is called a white, soft wheat, although the grain is one of the hardest we have yet examined, and the milling that of a hard wheat. This is only explicable by Mr. Farrer's suggestion that the term soft is used in India to denote bread wheats generally, a hard wheat signifying a macaroni wheat. Like the locally-grown Indian wheats, these are very heavy grains, fair to mill, giving a fair quantity of flour of great strength, the weakest, Pitsi Ekdan, being weevilly. The colour of the flour from the Indian-grown wheats is somewhat better on the whole, but they differ strikingly from the locally-grown Indian wheats in their quite remarkably low gluten-contents, and in the peculiar nature of their gluten.

From previous experiments made with the object of ascertaining the cause of the high strength of certain flours, one of us found that strength of flour was always associated with preponderance of glutenin in the gluten, the gluten of strong flours being more or less coherent and non-adhesive, the weak flours being rich in gliadin and yielding a sticky gluten.

Arguing from analogy, the gluten in these flours should be almost wholly composed of glutenin, their incoherent nature being presumably due to the almost total absence of the sticky, binding gliadin.

We hope shortly to be able to examine this point. The exact antithesis to it is afforded by the cross-bred rye-wheat (Willets x Alabama Rye) x Leak's R.R. (No. 18 in the summary, Table B), with a gluten-content of over 16 and a very low strength, the gluten being of an exceedingly sticky nature.

South Australian Wheats.

Table E, p. 767, gives the results of the examination of a few wheats grown in South Australia, and forwarded by Mr. M. Kahlbaum, head miller of the Adelaide Milling Company.

The first three wheats are extensively grown in South Australia, Nonpareil being one of the favourites. They are all three very easy milling wheats, with soft semolinas. Weight per bushel not very high, colour of flour good, though the South Australian millers tolerate a yellower tinge in their flour than is fashionable in New South Wales. Gluten-content high. The strength of these flours is lower, however, on the whole than ours. Mr. Kahlbaum tells me that this is characteristic of last season's harvest in South Australia.

These wheats were all harvested late in 1896.

No. 38, supposed Allora, resembles Allora Spring in appearance and in the way it mills, the differences being no more than might be expected from different climate and season, the Allora wheat previously examined being one of Mr. Farrer's harvest of December, 1893.

Nonpareil.—An examination of this same grain, harvested at Queanbeyan this season, was also made, and will be found in Table C (No. 22). It will be of interest to compare the results. They differ somewhat in appearance, the Queanbeyan product being the better-looking grain, larger and whiter. It is also a heavier wheat, otherwise the differences are slight. Their behaviour in the mill is very similar—the South Australian product milling rather the more easily of the two, and its bran being more readily cleaned; indeed, the bran of this wheat was perhaps unnecessarily cleaned. The flour, it will be seen, is very similar in both cases, there being about 1 per cent. more gluten in the South Australian flour. This is deservedly a favourite in South Australia, the points in which it is susceptible of improvement being weight of grain and strength of flour. Perhaps judicious cross-breeding or selection might result in still further improving this grain in these points.

Ward's Prolific, locally grown, harvested December, 1894, has also been examined. (*Agricultural Gazette*, February, 1896.) The grain in this case is very similar in appearance and size, and the milling very similar.

The flour from the sample, Ward's Prolific, harvested at Queanbeyan, December, 1894, gives the following numbers. (*Agricultural Gazette*, February, 1896.)

Colour	C 1
Gluten	9·09
Strength	46·8

A result in every respect inferior to the South Australian grain. Against this must be set the fact, already pointed out, that the season of 1894 was not a good one in Queanbeyan, gluten and strength being both very low.

The four wheats in Table F, p. 768, may be inserted for comparison's sake. They were grown in different parts of the Colony.

Blount's Lambrigg, it was stated, did not make good bread. It is difficult to understand why this should be the case, as it is an excellent flour. It is, of course, a far stronger flour than local bakers are accustomed to, and the baking process would have to be slightly modified. It gave an excellent loaf when baked on the small scale in the laboratory.

TABLE B.—HARVEST OF DECEMBER, 1896 (CROSS-BRED WHEATS).

	Variety of Grain.	Appearance of Grain.	Weight per bushel.	Milled Products. Flour.	Pollard.	Bran.	Colour.	Gluten.	Nature of Gluten	Strength.	Milling Notes.
*1	(Early Lambrigg) ..	Rather small, translucent and white, medium hardness.	60·6	71·9	19·3	8·8	C_3	15·45	Elastic, coherent, non-adhesive.	67·4	Fair to mill. 5 breaks, 5 reductions, 1 pollard on 2 sieve, 2 pollard on 11 sieve, 1 whole pollard, semolina slight yellowish tinge, and very slightly gritty, bran clean, pollard clean. The whole pollard looked capable of yielding more flour, hence its reduction, though not needed, to give 70 per cent.
*2	F (5)	Plump, translucent and white, medium hardness.	62·0	71·0	10·1	18·9	C_1	12·75	Slightly elastic, fairly coherent, adhesive.	47·4	Fair to mill. 5 breaks, 5 reductions, 1 pollard on 2 sieve, 2 pollard on 11 sieve, 1 whole pollard, flour clings very strongly to bran, semolina yellowish tinge and soft, bran not at all clean, pollard fairly clean. Though a softer wheat to mill than Nos. 1 and 3, yet the semolina was a shade more difficult to reduce. By mistake this wheat was allowed to drain for an hour (instead of five minutes.) This may have increased tendency of flour to cling to bran.
†3	F (4)	Fair size, dark, translucent, medium hardness.	62·5	76·8	14·65	8·55	C^1	12·65	Slightly elastic, fairly coherent, adhesive.	50·0	Fair to mill. 5 breaks, 5 reductions, 1 pollard on 2 sieve, 2 pollard on 11 sieve, 1 whole pollard. Flour clings to bran, semolina very slight yellowish tinge and very slightly gritty, bran not clean, pollard clean.
‡4	14 (A)	Fair size, translucent and white, translucent grains, medium hardness, white grains, soft.	61·6	72·2	9·6	18·2	C	11·77	Medium coherent, and elastic, slightly adhesive	48·4	Easy to mill. 5 breaks, 5 reductions, 1 pollard on 2 sieve, 2 pollard on 11 sieve, 1 whole pollard, semolina white and soft, flour clings very much to bran, bran not clean, pollard fairly clean, large.
5	Outpost = (Steinwedel x Amethyst) x Steinlee.	Large, translucent, medium hardness.	63·3	70·0	16·7	13·3	C_1 (slightly gray)	..	....	49	Rather easy to mill. 5 breaks, 5 reductions, 1 pollard on 2 sieve, 2 pollard on 11 sieve, no whole pollard reduction, semolina slight yellowish tinge and slightly gritty, bran large and clean, pollard not clean.
6	Planet = Steinwedel x (Amethyst x Hornblende.)	Medium size, dull, medium hardness.	60·9	72·8	14·9	12·3	C_2	14·57	Very soft, not very elastic, coherent, adhesive.	48·0	Fair to mill. 5 breaks, 5 reductions, 1 pollard on 2 sieve, 2 pollard on 11 sieve, no whole pollard reduction, semolina slight yellowish tinge and slightly gritty, bran fairly clean, pollard clean.
7	Thickhead = Steinwedel x (Amethyst x Hornblende).	Medium size, plump, dull, translucent, very hard.	62·1	69·0	12·4	18·6	C_1	12·51	Very soft, medium coherent, not elastic, adhesive.	48·4	Very difficult to mill. 5 breaks, 5 reductions, 1 pollard on 2 sieve, 4 pollard on 11 sieve, no whole pollard reduction, semolina rich yellowish tinge and gritty, bran fairly clean, pollard not very clean.
8	Rocket = Steinwedel x (Amethyst x Hornblende).	Medium size, translucent, hard.	63·7	71·8	13·7	14·5	C	11·39	Very soft, not very coherent, inelastic, adhesive.	44·8	Fair to mill. 5 breaks, 5 reductions, 1 pollard on 2 sieve, 2 pollard on 11 sieve, no whole pollard reduction, semolina slight yellowish tinge and slightly gritty, bran fairly clean, pollard clean.

NOTES TO TABLE, BY MR. FARRER.

* *Early Lambrigg.*—This variety and F (5), which both originated from the same sport from Blount's Lambrigg, are distinct varieties. † F (4) is a sport from another cross-bred {(Sicilian square-headed red x Hornblende) x (Hornblende x Ward's White)}. For examination of normal cross-bred from which F (4) sported, *vide* No. 28 of wheats harvested in 1894, which was a year of poor gluten-contents. ‡ 14 A is a sport from Improved Fife. These sports and their peculiarities are described more fully in Mr Farrer's paper on the "Improvement of Wheats," to be published shortly.

TABLE B.—*continued.*

	Variety of Grain.	Appearance of Grain.	Weight per bushel.	Milled Products.			Colour.	Gluten.	Nature of Gluten.	Strength.	Milling Notes.
				Flour.	Pollard.	Bran.					
9	Vanessa=(Hornblende x Indian A).	Small, white, medium hardness.	60·8	76·6	7·1	16·3	C_1	13·12	Coherent, not very elastic, non-adhesive.	56·0	Fair to mill. 5 breaks, 5 reductions, 1 pollard on 2 sieve, 2 pollard on 11 sieve, no whole pollard reductions, semolina yellowish and gritty, bran fairly clean, pollard clean.
10	Rajah = (Hornblende x Indian B).	Fair size, plump, white, medium hardness (softer than previous grain.	60·4	72·2	13·0	14·8	C_1	14·05	Medium soft, coherent, elastic, non-adhesive.	54·0	Fair to mill. 5 breaks, 5 reductions, 1 pollard on 2 sieve, 2 pollard on 11 sieve, 1 whole pollard reduction, semolina white and soft, bran large and not clean, as flour has tendency to cling, pollard clean. Though this had whole pollard reduction it must be termed "Fair to mill" owing to the ease of other reductions.
11	Hornblende x Indian D.	Medium, white, hard.	61·1	73·1	12·7	14·2	C_2	13·37	Soft, coherent, elastic, non-adhesive.	56·0	Rather difficult to mill. 5 breaks, 5 reductions, 1 pollard on 2 sieve, 3 pollard on 11 sieve, no whole pollard reduction, semolina white and gritty, bran clean, pollard fairly clean.
12	Roma = (King's Jubilee x Indian G).	Fair size, white, soft.	60·4	72·1	4·9	23·0	C	12·32	Soft, fairly coherent, non-adhesive.	54·0	Easy to mill. 5 breaks, 4 reductions, 1 pollard on 2 sieve, 2 pollard on 11 sieve, no whole pollard reduction, semolina slight yellowish tinge and soft, bran large and not at all clean, flour clings very much to bran, pollard very clean, large amount of flour from breaks, very little semolina to work upon in the last two reductions, though the quality appeared good.
§13	(Improved Fife x Blount's Lambrigg) x Steinlee.	Fair size, plump, white, medium hardness.	60·0	75·0	10·0	15·0	C_2	13·60	Soft, coherent, fairly elastic, slightly adhesive.	48·8	Rather easy to mill. 5 breaks, 5 reductions, 1 pollard on 2 sieve, 2 pollard on 11 sieve, no whole pollard reduction, semolina yellowish tinge and gritty, bran very large and fairly clean, pollard clean.
14	(Blount's Lambrigg x Hornblende) x King's Jubilee.	Fair size, plump, white, medium hardness.	60·0	73·3	10·1	16·6	C_1	12·29	Coherent, elastic, non-adhesive.	59·6	Easy to mill. 5 breaks, 5 reductions, 1 pollard on 2 sieve, 2 pollard on 11 sieve, no whole pollard reduction, semolina slight yellowish tinge and soft, bran large and fairly clean, pollard clean.
15	F (4) x (Improved Fife x Etawah).	Fair size, white, medium hardness.	60·2	73·0	9·8	17·2	C_1	13·03	Medium coherent, medium elastic, slightly adhesive.	50·2	Fair to mill. 5 breaks, 5 reductions, 1 pollard on 2 sieve, 2 pollard on 11 sieve, no whole pollard reduction, semolina slight yellowish tinge and slightly gritty, bran not clean, pollard clean.
16	F (4) x Vanessa ..	Medium size, translucent, and medium hardness.	60·5	73·3	11·1	15·6	C_1	14·04	Medium coherent and elastic, non-adhesive.	54·4	Fair to mill. 5 breaks, 5 reductions, 1 pollard on 2 sieve, 2 pollard on 11 sieve, 1 whole pollard, semolina slight yellowish tinge and slightly gritty, flour clings to bran, bran not clean, pollard clean.
17	{(Sicilian square-headed Red x Hornblende) x Improved Fife} x (Vanessa x Indian B).	Fair size, white, medium hardness.	60·2	70·9	12·2	16·9	D	14·64	Tough coherent, elastic, slightly adhesive.	52·8	Rather easy to mill. 5 breaks, 5 reductions, 1 pollard on 2 sieve, 2 pollard on 11 sieve, no whole pollard reduction, semolina slight yellowish tinge and gritty, bran not very clean, pollard clean.
18	(Willet's x Alabama Rye) x Leak's R.R.	Medium translucent, hard.	59·5	72·7	13·6	13·7	D_2	16·42	Soft, medium coherent, inelastic, adhesive.	41·6	Fair to mill. 5 breaks, 5 reductions, 1 pollard on 2 sieve, 2 pollard on 11 sieve, no whole pollard reduction, semolina rich yellow tinge and gritty, bran clean, pollard clean.

§ Steinlee is (Steinwedel x King's Jubilee).

Table C.—Harvest of December, 1896 (Wheats other than Crossbreds.)

	Variety of Grain.	Appearance of Grain.	Weight per bushel.	Milled Products.			Colour.	Gluten.	Nature of Gluten.	Strength.	Milling Notes.
				Flour.	Pollard.	Bran.					
*19	Maize Wheat	Very small, round, hard.	62·9	70·3	16·0	13·7	D	14·57	Fairly elastic and coherent, slightly adhesive.	54·6	Difficult to mill. 5 breaks, 6 reductions, 1 pollard on 2 sieve, 3 pollard on 11 sieve, no whole pollard reduction, semolina rich yellow tinge and gritty, bran very small and fairly clean, pollard not very clean.
20	Common Bladette ..	Long, dull, rather soft.	59·0	72·2	14·2	13·6	C_2	14·36	Medium elastic and coherent, adhesive.	46·2	Fair to mill. 5 breaks 5 reductions, 1 pollard on 2 sieve, 2 pollard on 11 sieve, no whole pollard reduction, semolina yellowish with pink tinge and soft, bran fairly clean, pollard clean.
21	French Early White..	Large, plump, translucent, hard.	62·8	74·7	12·65	12·65	C_2	13·57	Soft, non-coherent, adhesive.	44·0	Fair to mill. 5 breaks, 5 reductions, 1 pollard on 2 sieve, 2 pollard on 11 sieve, no whole pollard reduction, semolina slight yellowish tinge and gritty, bran and pollard both clean, flour parts easily from bran, the semolina required harder milling than in previous samples, heavy flour.
22	Nonpareil	Fine, large, plump, white, medium hardness.	62·5	73·7	10·1	16·6	C_1	12·96	Tough, coherent, elastic, slightly adhesive.	49·2	Easy to mill. 5 breaks, 5 reductions, 1 pollard on 2 sieve, 2 pollard on 11 sieve, no whole pollard reduction, semolina yellowish tinge and very slightly gritty, bran fairly clean, pollard fairly clean.
†23	Budd's Early	Medium size, white, medium hardness.	60·1	71·4	6·2	22·4	C_1	12·14	Medium coherent, medium elastic, adhesive.	45·0	Fair to mill. 5 breaks, 5 reductions, 1 pollard on 2 sieve, 2 pollard on 11 sieve, no whole pollard reduction, semolina slight yellowish tinge and soft, flour clings to bran, bran not at all clean, pollard fairly clean.
24	White Lammas ..	Large, very plump, white, soft.	60·4	76·5	10·7	12·8	C_2	14·09	Medium coherent, medium elastic. medium adhesive.	51·0	Easy to mill. 5 breaks, 5 reductions, 1 pollard on 2 sieve, 2 pollard on 11 sieve, no whole pollard reduction, semolina very faint yellowish tinge and soft, bran large and clean, pollard very clean, large amount of flour from breaks.
25	White Tuscan ..	Medium size, translucent, medium hardness.	63·6	72·7	12·7	14·6	C	12·26	Medium soft, medium coherent, slightly adhesive.	44·4	Fair to mill. 5 breaks, 5 reductions, 1 pollard on 2 sieve, 2 pollard on 11 sieve, no whole pollard reduction, semolina yellowish and very slightly gritty, bran fairly clean, pollard clean.
26	Indian H.	Small, white, medium hardness.	61·6	72·8	11·8	15·4	C_4	12·72	Non-coherent, slightly elastic, non-adhesive.	60·2	Fair to mill. 5 breaks, 5 reductions, 1 pollard on 2 sieve, 2 pollard on 11 sieve, no whole pollard reduction, semolina rich yellowish tinge and gritty, bran fairly clean, pollard fairly clean.

* "Maize" wheat is an Indian variety with peculiar heads, and very short, rather maize-like, grain.

† From its appearance, Budd's Early is not unlikely a cross between "Ward's Prolific" and "Allora Spring." Its milling qualities are such as might be expected from this cross.

TABLE C—*continued*.

	Variety of Grain.	Appearance of Grain.	Weight per bushel.	Milled Products. Flour.	Pollard.	Bran.	Colour.	Gluten.	Nature of Gluten.	Strength.	Milling Notes.
27	Indian B.	Fair size, translucent, hard.	62·9	70·0	13·6	16·4	C_2	12·16	Not very coherent, non-elastic, slightly adhesive.	52·4	Fair to mill. 5 breaks, 5 reductions, 1 pollard on 2 sieve, 2 pollard on 11 sieve, no whole pollard reduction, semolina slight yellowish tinge and slightly gritty, bran and pollard not very clean.
28	Indian J. . .	Fair size, translucent, medium hardness.	63·6	71·4	11·3	17·3	C_1	12·97	Moderately cohesive and elastic, non-adhesive.	58·0	Fair to mill. 5 breaks, 5 reductions, 1 pollard on 2 sieve, 2 pollard on 11 sieve, 1 whole pollard reduction, semolina yellowish tinge and gritty, bran not very clean, pollard fairly clean.
29	Indian K.	Fair size, long, translucent, hard.	62·5	70·8	18·06	11·14	C_1	13·55	Soft, fairly coherent, non-adhesive.	53·2	Rather difficult to mill. 5 breaks, 6 reductions, 1 pollard on 2 sieve, 2 pollard on 11 sieve, no whole pollard, the sixth reduction being made instead, owing to the rather large amount of semolina remaining after fifth reduction, semolina yellowish and gritty, bran not very clean, pollard fairly clean.
30	Indian N.	Fair size, long, translucent, hard.	63·5	76·5	14·1	9·4	C_3	14·22	Softish, medium coherent, and slightly adhesive.	52·0	Rather difficult to mill. 5 breaks, 6 reductions, 1 pollard on 2 sieve, 2 pollard on 11 sieve, no whole pollard, a sixth reduction being made, as in previous wheat, semolina yellowish and gritty, bran very clean (perhaps a little over-milled), pollard clean.
31	Etawah .. .	Fair size, translucent, hard.	64·3	76·0	13·6	10·4	C_3	13·80	Coherent, elastic, non adhesive.	54·8	Fair to mill, though semolina was slightly difficult to mill. 5 breaks, 5 reductions, 1 pollard on 2 sieve, 2 pollard on 11 sieve, 1 whole pollard reduction, semolina yellowish and gritty, bran clean, pollard clean.
32	Vilmorin's Indian .	Medium size, round, plump, medium hardness.	60·8	72·6	12·83	14·57	D	17·43	Fairly coherent, slightly adhesive.	46·8	Rather easy to mill. 5 breaks, 5 reductions, 1 pollard on 2 sieve, 2 pollard on 11 sieve, semolina yellowish tinge and soft, bran thin and clean, pollard clean. The wheat should not have remained in the water the usual two minutes, as it milled rather clammy in the breaks.
33	Gore's Indian, No. 7 (1).	Fair size, translucent, hard.	63·6	67·1	13·7	19·2	C_2	12·41	Soft, not very coherent, non-elastic, slightly adhesive.	54·4	Rather difficult to mill. 5 breaks, 5 reductions, 1 pollard on 2 sieve, 2 pollard on 11 sieve, 1 whole pollard reduction, semolina rich yellowish tinge and gritty, flour clings very much to bran, bran not clean, pollard fairly clean.

Table D.

Indian Wheats (Grown in India).

	Variety of Grain.	Appearance of Grain.	Weight per bushel.	Milled Products.			Colour.	Gluten.	Nature of Gluten.	Strength.	Milling Notes
				Flour.	Pollard.	Bran.					
34	Pitsi Ekdan	Large, plump, white, hard.	63·8	78·0	8·8	13·2	B_4	9·61	Gray, fairly coherent, soft, slightly adhesive.	50·8	Easy to mill. Five breaks, 4 reductions, 1 pollard on 2 sieve, 2 pollard on 11 sieve, no whole pollard reduction, semolina white and gritty, flour clings very much to bran, bran not clean, pollard clean, remarkable quantity of flour. This wheat was badly ttacked by weevil.
35	**Muzaffar Nagar (white, soft, bald wheat).**	Fair size, dark, translucent, very hard.	63·1	75·0	11·8	13·2	C_2	10·29	Very incoherent, inelastic, non-adhesive.	61·2	Difficult to mill. Five breaks, 5 reductions, 2 pollard on 2 sieve, 3 pollard on 11 sieve, no whole pollard reduction, semolina rich yellowish tinge and very gritty, bran clean, pollard fairly clean.
36	**Muzaffar Nagar (white bearded wheat).**	Fair size, white, soft.	63·1	69·6	12·9	17·5	C	6·07	Very incoherent, non-adhesive.	57·0	Fair to mill. Five breaks, 5 reductions, 1 pollard on 2 sieve, 2 pollard on 11 sieve, no whole pollard, semolina rich yellow tinge and soft, flour tendency to cling to bran, bran not very clean, pollard fairly clean.
37	**Buxar (soft, white)** ..	Small, plump, white, soft.	63·5	72·6	9·6	17·8	C	7·24	medium coherent, non-adhesive.	55·2	Fair to mill. Five breaks, 5 reductions, 1 pollard on 2 sieve, 2 pollard on 11 sieve, no whole pollard reduction, semolina yellowish tinge and gritty, bran fairly clean, pollard very clean.

Table E.

South Australian Wheat: harvested December, 18

	Variety of Grain.	Appearance of Grain.	Weight per bushel.	Milled Products. Flour.	Pollard.	Bran.	Colour.	Gluten.	Nature of Gluten.	Strength.	Milling Notes.
38	Supposed "Allora" ..	Medium, white, soft.	Insufficient grain.	77·0	9·1	13·9	C	9·98	Soft, gray, medium elastic and coherent, adhesive.	46·0	Very easy to mill. Five breaks, 4 reductions, flour clings to bran, semolina white, bran not very clean, pollard very clean, quantity milled very small.
39	Dart's Imperial ..	Fair size, translucent, soft.	62·0	71·8	14·2	14·0	C	11·38	Soft, not very coherent, fairly elastic, adhesive.	47·6	Easy to mill. Five breaks, 5 reductions, semolina yellowish tinge and soft, bran not very clean, flour clings slightly to bran, pollard clean.
40	Nonpareil	Small, dull, opaque, soft.	61·5	72·6	14·5	12·9	C_1	14·12	Medium, hard, elastic, coherent, non-adhesive.	49·2	Very easy to mill Five breaks, 5 reductions, no reduction on whole pollard, semolina yellowish and soft, bran and pollard clean.
41	Supposed "Durum" (grown as hay-wheat, Launceston, Tasmania).	Large, translucent, very hard.	62·4	76·0	16·8	13·6	E	12·42	Soft, yellow, medium coherent, inelastic, adhesive.	44·0	Difficult to mill. Five breaks, 6 reductions, bran easily cleaned, semolina rich yellow and very gritty, bran very clean, pollard clean.
42	Ward's Prolific (grown near Port Pirie).	Rather small, translucent, medium hardness.	61·5	73·7	17·5	8·8	C	12·74	Medium coherent, medium elastic, adhesive.	48·0	Fair to mill. Five breaks, 5 reductions, 1 pollard on 2 sieve, 1 pollard on 11 sieve, no whole pollard reduction, semolina yellow and slightly gritty, bran fairly clean, pollard clean.
43	The above milled by a different method.	....	..	71·5	6·9	21·6	C	12·66	do ..	48·0	
44	Bearded American ..	Fair size, translucent, medium hardness.	61·7	71·0	15·0	14·0	C_1 grayish.	13·29	do ..	46·6	Fair to mill. Five breaks, 5 reductions, 1 pollard on 2 sieve, 1 pollard on 11 sieve, no whole pollard, semolina slight yellowish tinge and very slightly gritty, bran not very clean, pollard clean.

TABLE F.

Variety of Grain.	—	Appearance of Grain.	Weight per bushel.	Milled Products. Flour.	Pollard.	Bran.	Colour.	Gluten.	Nature of Gluten.	Strength.	Milling Notes.
Gallant's Hybrid ..	From Haywood Bros., Pambula, 1896.	Plump, white, medium hardness.	59·1	79·8	12·57	7·63	..	6·26	......	46 6	Easy to mill. Flour leaves bran easily, semolina slight yellowish tinge and gritty, bran very clean, pollard not very clean.
Quartz	From Mr. Allen, 1897.	Pinched, white, soft.	58·8	70·6	17·0	12·4	D 3	15·29	Gray, soft, medium, coherent and elastic, slightly adhesive.	50·0	Easy to mill. Five breaks, 5 reductions, 2 extra reductions, flour clings to bran, semolina slight yellowish tinge and slightly gritty, bran fairly clean, pollard clean.
Blount's Lambrigg..	From J. Richardson & Co., Armidale, 1897.	Small, hard, translucent.	61·7	71·5	14·6	13·9	C 1	11·16	......	55·4	Fair to mill. Five breaks, 5 reductions, 1 pollard on 2 sieve, 2 pollard on 11 sieve, no whole pollard, semolina yellowish tinge and gritty, semolina hard to mill, bran small and clean, pollard fairly clean.
Flour from the same wheat, milled by J. Richardson & Co., Armidale			..	..	..	..	C	9·18	......	60·0	

Fruit-drying.

W. J. ALLEN,
Fruit Expert.

The subject of fruit-drying is a most important one to all orchardists, as hitherto the grower has been content to market his fruit in the fresh state, and has had to take what prices he could get, which were often very low, and in many instances scarcely paid the freight and marketing. In a colony like this, with every advantage of climate, there is no necessity for the grower to plod along in the old lines laid down by his father and his grandfather before him, content with whatever he can get for his fruit, and satisfied that so long as it is a peach, or a pear, or an apple, or an apricot, as the case may be, that one variety is as good as another. Let him ascertain which are the best varieties for their respective purposes. These are good for dessert—well, plant as many as he thinks he can dispose of in that way; those are good for export—well, plant a certain number for that purpose; and for the rest of his trees plant such fruits as can be dried.

It is significant of the little attention which the subject of fruit-drying has received in this Colony that we are dependent almost entirely upon other colonies and countries for our dried fruits. This ought not to be where there are so many thousands of acres admirably adapted for raising fruits suitable for drying, as well as the climate necessary to produce the best dried fruits. In fact, in many of the interior districts the climate is so well adapted for fruit-drying, owing to the absence of fogs and moisture in the air, that the drying process could go on day and night. This lessens the chance of the moths depositing their eggs in the fruit, as it is not exposed for so long a time, and has also this advantage—that the fruit drying quickly, the trays can be emptied sooner than they could be in moister or cooler climates, and this enables the grower to handle a large crop with fewer trays—a great consideration to all orchardists. Great care must be taken in the selection of trees, keeping in view the necessity of choosing such as produce the best drying fruits—that is, for colour and size, and such as will lose the least weight in drying. One of the objects (in fact, the main object) being to produce a dried fruit of good size and bright clear colour, which, when graded and properly packed, will present a most attractive appearance.

The previous remarks apply mostly to sun-drying, but in districts where this is not practicable good results may be obtained by drying in the evaporator, and where this process is used it has the advantage that, with careful handling after the fruit is dried, there is very little risk of the fruit becoming infested with moths.

Apricot-drying.

As previously suggested, the planter should choose and grow only those kinds which make a good, bright, clear-coloured fruit, and one which does not dry away too much during the process. To begin with, the tree must receive, from the time of its planting, the necessary care and attention to enable it to produce a good crop of the very best fruit, both for quality and size. This necessitates systematic and judicious pruning and thinning. If

it is seen that a tree has set too much fruit, or more than it can possibly develop properly, pick off or thin evenly over the whole tree, leaving only such quantity as the tree will properly develop.*

If irrigation is carried on, and the climate is very dry, do not be afraid to irrigate the trees at the time of ripening if they appear to require it, as a little neglect at this particular time may make a great difference in the quality of the dried fruit. In a cool, moist climate I would recommend the orchardist to pay particular attention to his cultivation. To make the best dried fruit, allow the apricots to hang on the tree until they are perfectly ripe, but not over-ripe, or so that they cannot be cut in halves with a sharp knife and still retain their shape. When the fruit is fairly soft, pick it carefully into cases; this will necessitate going over the trees five or six times in all probability. As soon as possible have the cases carted to the cutting-shed, where the fruit should be carefully and evenly cut in halves (not pulled apart) and the pits removed. Place evenly on the trays with the cut side up, and as soon as possible remove each tray to the fumigator, where it may remain, with the door closed, until the fumigator is sufficiently full to start the sulphur burning. This is of the utmost importance, as when once the fruit has been cut it must not be exposed to either sun or wind. When everything is ready place sufficient sulphur or brimstone to fill the room with the fumes for about three hours (from 1 lb. to $2\frac{1}{2}$ lb. according to size of room); but if possible allow the fruit to remain in the sulphur-room from eight to ten or twelve hours, or until the cup† is full of juice. It can then be taken out and placed either in the sun or in the evaporator (as the case may be) immediately. If in the evaporator, do not place the fruit in the hottest part to begin with, but gradually work from the cooler to the hotter part, (say) starting at that part which is 140 degrees, and finishing off at 160 degrees or 170 degrees. In this way the fruit will dry in from fourteen to eighteen hours, but the greatest care must be taken not to allow it to burn, and some practice will be required to tell when it is just dry enough.

If the fruit is to be dried in the sun use wooden trays, 2 ft. x 3 ft., which are made for the purpose, with a 2-inch cleat at both ends. These are easily handled, and can be used in connection with all fruits. In cutting the fruit and placing it on the trays, place it on the top part or so that the cleats at the ends will be resting on the ground, thus allowing a current of air to pass underneath and assist in the drying process. If the weather is hot, which it usually is about Christmas-time, it will take from two and a half to three and a half days to dry the fruit, which will require to be sorted over, so that any which is not quite dry may be put on other trays and allowed to stand for another half day or so. The dried fruit should be taken from the trays and put into clean calico bags immediately and securely tied, so that the moths may not reach it. When sorting over in the above manner, any fruit which is small or of bad appearance should not be mixed up with the good, but sorted out and marked as inferior; while the good also can be marked accordingly. When the fruit is dried and bagged it should be at once stored in a cool, dry place; if exposed to heat it will become hard, lose in weight, and deteriorate in quality.

* I would advise that this thinning should be done at two different times, the first thinning to be done about three weeks after the fruit is well set, and a final thinning when the stone is well formed, as in stoning very often the tree thins itself, a good many of the fruits dropping at this period.

† That is the depression where the pit was removed from.

Should, by any mischance, the moths have got into the fruit and deposited their eggs therein, an effectual means of cleaning or ridding such infested fruit is to dip it into boiling hot water for a few seconds, and then spread on trays and allow to dry by exposure to the sun's rays for a few hours.

Peach-drying.

The process of drying peaches is very similar to that followed with apricots, but there are so many hundreds of poor varieties grown that it is very difficult to find peaches that make a first-class or commercial dried fruit. A freestone is really the only variety to grow for drying purposes, and one with a firm, yellow flesh, not too juicy and above medium size. A peach of this description will make the very best commercial article, and one which when properly dried and packed would bring the highest price. A clingstone peach will dry, but will not sell so readily, and brings a much lower price. It is true it will not dry away so much, but with the market as it is, with keen competition from America, it will not pay the grower to place an inferior article on the market, for three reasons, viz.:—(1) Inferior fruits placed upon the market tend to lower the prices of good fruits; (2) they sell at such low prices that it barely pays the grower for his work in picking, curing, packing, and marketing; (3) they are usually the last fruits on the market to be sold, and very few wholesale dealers care to handle such fruit, and, in consequence, will accept almost any offer to get rid of it.

I have in previous articles named certain good varieties which are especially worthy of notice.

Although in California peeled peaches have always brought a much higher price than the unpeeled, they have not, in Victoria, sold for sufficiently more to pay the grower for the extra trouble of peeling, and in consequence nearly all dried peaches found on the market are unpeeled. With some varieties it is found that the skin will slip off quite easily with a slight pressure of the thumb and finger immediately after the fruit has been fumigated, while other varieties require the use of a peach-peeling machine.

For drying, the peaches should be cut evenly in halves, placing them on the trays with the cut side up, in every way similar to the apricot, except that at the most, they only require two hours' fumigating; but if desired they may remain for a longer time in the sulphur-room, by opening the doors and allowing the air to circulate freely through the trays, after which they are placed in the evaporator or in the sun, as the case may be, and exposed to the same temperature as the apricot. They should be removed from the tray while quite pliable and not allowed to over-dry, then tied in calico bags and stored in a cool, dry place until ready to pack. If peaches are very uneven in size it is best to keep the different sizes together on the trays, as they dry more evenly than if the large and small fruits are mixed on the same tray.

Nectarines.

This fruit is handled in a similar manner to the peach, requiring the same treatment. I have seen them peeled, but as they dry away considerably the practice is to dry without peeling.

Prune Culture and Drying.

In the prune-growing districts of California and Oregon the following varieties of plums have as yet been most extensively grown for converting into prunes by the process of drying, have been found to bear fairly well, and proven profitable, viz.:—Prune d'Agen, or French prune, which is of

medium size, with greenish-yellow flesh, full of sugar, rich, but clings slightly to the stone. Tree hardy and very productive.

Italian Prune.—This variety makes a good-sized prune, larger than the Prune d'Agen, but the tree is not quite so free a bearer. The dried fruit is of excellent quality, and is bluish-black in colour when dried, and freestone.

Silver Prune is a rich fruit, of good quality, but is inclined to be a shy bearer. It dries a light colour, and is one of the largest grown.

I have named the above three varieties, as in California they have produced the best crops of good, commercial fruit; there are, however, several other varieties which have done nearly as well, these being German Prune, Reine Claude de Bavay, Bulgarian and Giant.

Drying.

The fruit should not be picked until it is thoroughly ripe; then dip it in a solution consisting of 1 lb. of concentrated lye to 10 gallons of water, to be brought to the boil, and the fruit immersed from five to ten seconds, according to the toughness of the skin, or just long enough to slightly crack the skins. The fruit, which should be placed in wire or perforated metal baskets, should be dipped in the solution when it is just off the boil, and immediately after immersed in fresh, cold water, so as to rinse it. It should then be spread on trays, and in the case of Silver or light-coloured prunes, should be put into the fumigator just long enough to set the colour well. After this the prunes are placed in the sun or evaporator (as the case may be). In the latter event the temperature should be about 130 degrees to start, and increased to 170 degrees or 180 degrees, this usually covering from one to two days, according to the size of the fruit. The fruit, when done, should be pliable; and when removed from the evaporator should be allowed to lie in sweat-boxes for a fortnight, so as to even up; then graded and neatly packed in boxes lined with white paper.

There is a machine which is used to prick the skins in place of dipping, which some people claim does equally good work, if not better.

The length of time required for drying the different varieties in the evaporator varies according to size. The smallest are sometimes dried in less than a day, while the largest take two days.

The fruit should be properly graded before being packed, and classed as follows:—20 to 30's, 30 to 40's, 40 to 50's, &c., up to 120.

Figs.

The fig is only fit for drying when it is dead ripe, as if dried when only partially ripe the fruit will be found worthless, and possessing none of the rich flavour which characterises the well-developed and ripe fruit. The varieties which have been found to bear fairly well, and make a very good dried fruit, are the White Adriatic and White Genoa, the former, I consider, being the better of the two.

The Smyrna fig, as grown in Smyrna, makes the best dried article; but, as yet, they have not been successfully grown here, as in no instance have I seen the fruit mature.

When the figs are picked they are placed on trays, with the bloom end down, and exposed to the sun for two or three days, when they should be turned. If picked when properly ripe, it should not take longer than five days of our ordinary summer weather to dry the fruit; but they must not be allowed to get at all hard, being taken up while quite pliable. After the figs are dried it is well to place them in a tight box, with a weight on the top, to press them firmly together. By this means they will even up, all being brought

to a uniform degree of dryness. In a week's time they are ready for packing; but before packing the fruit should be dipped into a weak brine, which not only assists crystallisation, but also adds to its appearance. In packing, the figs should be well worked out between the thumb and finger, and packed in boxes or drums holding from 1 lb. to 28 lb. I have improved the appearance of figs by the use of a little sulphur; but as I have seen so many dried figs practically ruined by over-sulphuring, I would not recommend its general use.

Apples.

With the exception of some of the very juicy apples, nearly all of these will make a marketable fruit, although the most suitable are the larger cooking varieties, with firm white flesh. It is necessary to have a good machine, which will peel, core and slice at the same time. The fruit is then placed on trays (wooden ones being largely used for this purpose in America, as it is claimed by many that the galvanised wire slightly damages the fruit during the process of sulphuring and drying; however, as yet this is a disputed question), and subjected to sulphur fumes just long enough to set the fruit a nice light colour. Great care must be exercised in the sulphuring, as if the fruit is left too long it becomes strongly flavoured with the sulphur, and consequently of very little value. Also, it must not be allowed to stand any length of time before being placed in the sulphur-room, as it discolours rapidly. After being bleached the fruit is placed in the evaporator, and allowed to remain there until perfectly dry—that is, from six to eight hours exposed to a temperature ranging from 140 degrees to 160 degrees. Care must be taken not to allow the fruit to burn or bake, as it would in either case harden as soon as exposed to the air. It is then put into sweat-boxes, and allowed to stand for a few days, so as to even up the whole. Care must now be taken to keep the dried fruit away from the moths, otherwise they will get in and deposit their eggs, and the fruit will be spoilt. If the fruit is to be kept for some time before packing it is always best to keep it in calico bags, securely tied.

Pears.

This fruit can be treated in every way similarly to the apple.

Raisin Grapes.

It will be found that the best raisin grapes are grown on the lighter and richer soils, and I have never yet in the colonies seen a first-class raisin made from grapes grown on a stiff soil.

To make a good table raisin, the grape must be grown to perfection—that is, the grape when ripe should be large, thin-skinned, fleshy, and containing plenty of sugar, and the bunches must be well filled, the larger the cluster the better the appearance of the fruit will be.

For making either pudding or table raisins, be sure that the fruit is perfectly ripe before picking, as for the latter purpose an under-ripe grape, when exposed to the sun, will turn red (in most cases), and will also take longer to dry than a ripe one, and when dried will be a sour and inferior raisin. My experience with regard to picking is that, in nine cases out of ten, the inexperienced fruit-grower imagines that as soon as his fruit is sweet enough to eat, the grapes are ready to pick for raisin-making, and, contrary to all advice, will start picking, only to find out at the end of the first week that the grapes are not turning a good colour. He then decides to stop picking (if, indeed, it is not too late, and the grapes all picked) for a fortnight, so as to allow his fruit to become thoroughly ripe.

The only grapes which have so far produced a good commercial raisin in Australia are the Gordo Blanco and the Muscat of Alexandria. I have had samples of raisins sent to me made from other kinds of grapes, which did not present a bad appearance; but if the grower placed these on the market to compete with the raisins made from the Gordo and Muscat, he would find that they would not sell so long as the latter were obtainable.

The process of curing the table raisin is as follows:—Pick the very best clusters—that is, only such as are well filled with large fine grapes—cut out all damaged or hard grapes, and lay the bunches carefully on the trays, which are then placed in the sun. By the end of one week one side should be fairly well dried, and the bunches should now be turned. This turning is accomplished by placing an empty tray on the top of the full one, two men can then take hold of the sides and invert the two, thus exposing to the sun the side of the fruit which had been lying next to the tray. After this turning it usually requires another week to finish the drying process, if the weather is favourable—that is, dry, warm days and nights. It usually takes from two to three weeks, under favourable circumstances, to cure good layer raisins; but if the weather is damp or threatening, it is better to stack up the trays at night, covering the stacks up with empty trays. If a table raisin gets wet during the curing process, it darkens the stem, and spoils the bloom, and thus lowers the grade and value of the fruit. I do not consider that it will ever pay to cure table raisins in the evaporator, as they require to be dried slowly, and when exposed to a temperature, while drying out of doors, of more than 96 degrees, they will burn, and thus spoil the sample. I do not consider they could stand more than 110 degrees in the evaporator, and I doubt if the green fruit could stand even this temperature without it having a damaging effect. Therefore I would not recommend growing grapes for raisins in a climate where the evaporator would have to be resorted to.

Pudding Raisins or Lexias.

Grapes intended for this purpose should also be picked when fully ripe; all partially ripe and dried fruit should be removed, and the grapes then immersed for about three seconds in a lye made in the proportion of 1 lb. of caustic soda to 8 gallons of water, and this *must* be kept just under the boil, as the dip will lose its effect if the lye is only fairly hot, and the fruit, instead of turning out a nice golden colour, would be brown. This, however, is not always the cause of the raisins being brown in colour, as it is impossible to make a good, bright Lexia, or good quality of raisin of any sort, from grapes grown on some of the heavier or stiffer soils. After the dipping process, it usually takes from five to eight days for the fruit to dry—this depending on the weather. About the fourth day after dipping, the grapes should be turned, but do not allow the fruit to become too dry before taking it in, a nice pliable fruit being always the best. If there is any uncertainty as to whether the fruit is sufficiently dry or not, it can be tested by squeezing a few of the raisins between the thumb and finger, and if no moisture exudes, then the fruit is quite dry enough. The Lexias should be stemmed and graded as soon as possible after they are dry enough to remove from the tray to the sweat-box, as if allowed to stand any length of time the stem becomes toughened and hard to separate from the raisin.

Curing Sultanas.

My advice to those growers of sultanas who have never yet dried any is to this effect: When you think the fruit is ripe enough to pick, leave it for at least another fortnight, as when they are quite sweet and fit to eat they are

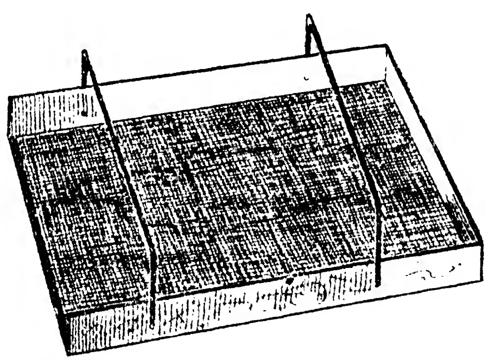
not by any means fit to dry. When they are a clear amber colour and perfectly sweet, without a trace of acidity in any of the berries, they should be about ready to pick. The last fortnight, before the fruit has attained this stage, adds considerable sugar, which means increased weight and a better quality of dried fruit—consequently it is best to pick when it is dead ripe, and dip as soon after as possible in a lye made in the proportion of 1 lb. of caustic soda to 8 gallons of water. The fruit must be dipped while the lye is just under the boil, but must not be immersed for longer than two seconds, after which the grapes are spread thinly on the ordinary drying-trays and exposed to the sun for a day or two. If the weather is very hot, the trays may be stacked up and allowed to remain thus until the sultanas are dry. Never expose sultanas to too great a heat, or the colour will not be good, and it is essential, if the grower desires to get the best prices for his fruit, to make a good, light-coloured article.

Zante Currant Curing.

The Zante currant is very easily cured. Allow the fruit to hang until thoroughly ripe—that is, until some of the currants begin to shrivel on the bunches, then pick and place on trays, but do not fill these too full, or the fruit will roll off. Expose to the sun for four or five days, when they should be dry enough to put in bags. Care must be taken with this fruit, as, if exposed too long, the moths will infest it, so that I strongly recommend bagging it until the fruit is stemmed and properly packed.

Dipping-Trays.

These are made of heavy galvanised wire-netting, $\frac{1}{4}$-inch mesh, to be nailed on a frame 2 feet wide by 3 feet long and 4 inches high, and not less than an inch in thickness, one end of the tray to be left open for convenience in sliding the fruit from the dipping to the drying trays. This end, however, must be strengthened with a piece of $\frac{3}{8}$-inch by 1-inch iron across this end and screwed to the side-pieces. Two handles to be joined to the sides of the tray—one at either end, and so made that when the tray is being filled the handles will just drop down over the end of the tray, and thus not interfere with the filling. The accompanying illustration will convey a fair idea of what is meant.



Fumigating and Sulphuring.

The fumigator should be built handy to the cutting-sheds and drying-ground. It should be large enough for the requirements of the orchard, but I would not recommend building a room so small that it would not hold at least a hundred trays—that is, unless the grower has only a few trees, when almost any fairly air-tight box capable of holding a dozen trays would answer the purpose.

A good-sized room for an ordinary orchardist is one 9 feet by 10 feet and 6 ft. 6 in. high on the inside, built of tongued and grooved boards, and put together with white lead. Any small cracks can be filled up with putty, and if the room should be found to leak, it can be papered inside. Fruit sulphured in a large room rarely ever tastes of the sulphur, and this is the great advantage of having a good-sized room, even though it takes a little more sulphur. A room such as this will hold 300 trays quite easily, and requires about 2 lb. of sulphur.

If the orchardist has only a small quantity of fruit to handle this could be sulphured by taking a good-sized packing-case capable of holding a dozen trays; paper it inside, and having stacked the trays one on top of another, place the box over the top of the whole. This should be placed partly over a hole in the ground, previously dug for the purpose, and from 2 ft. 6 in. to 3 feet deep, wherein the sulphur is to be burnt in a small iron pot. When the sulphur is lit, cover the hole closely on the outside with a piece of iron or board, so that the fumes cannot escape.

Drying-trays.

These are made with either three or four boards. I prefer the three boards, as there are not so many cracks, which is an advantage in curing small fruits such as sultanas, currants, &c., and they appear to hold together better. I am speaking from experience, as I have been accustomed to using twenty thousand at a time on which to cure raisins in California, and as many in drying apricots. The same class of tray was used in Mildura, where we also handled fully as many.

A good tray is made as follows:—The ends or cleats are made $2\frac{1}{4}$ inches wide and $\frac{7}{8}$ inch thick; the three boards $\frac{1}{3}$-inch thick are then nailed securely on these cleats by driving four nails in each end—nails to be 2-inch round wire nails with flat heads. Such a tray as this is useful for any fruit drying in the sun, and can also be used for storing lemons and oranges by placing in sweat-boxes with a layer of fruit on each.

In drying fruit, these trays, when necessary, can easily be stacked one on top of the other, and the stack covered with two empty trays to keep the rain off.

These trays should not cost more than 6d. or 7d. each by the thousand in Sydney.

Drying-ground.

It was thought at one time that a lucerne paddock would make an excellent drying-ground, and so it does, but the fruit dries more slowly than it does on the dry ground, and it has been found that the moths are much more troublesome, so that of late years the lucerne has been abandoned, and any clean unbroken ground used instead. This, of course, has its disadvantages, as the dust rises easily, and great care should be taken to keep the ground sprinkled wherever it has to be walked over. By taking this precaution the fruit can be kept quite clean, and it dries more quickly than when the trays are spread on lucerne.

In spreading the trays do not leave roadways between them, but place them side by side, so that the whole ground is covered, and thus there are only the outside trays to watch. This applies to the stone-fruits more particularly. In placing raisins out to dry it is necessary to place the trays so that the fruit can easily be turned, therefore in this case it is necessary to leave a narrow roadway between the rows of trays.

The Culture of Tobacco.

A. M. HOWELL,
Tobacco Expert.

In the beginning of my labours in New South Wales, it is becoming that I should avoid the too lavish use of positive assertions on the subject which most concerns me—the culture of tobacco.

What may seem to be conditions exactly similar to those of the famous tobacco districts of the Southern States of America may, in practical field and barn operations, prove to be very dissimilar when brought to the test in this climate. Nevertheless, if good tobacco is a paying crop here, I would not hesitate, from observations so far made, to advise continued effort in its culture.

In regions that I have visited considerable areas of the soil seem to be all that could be desired for the production of excellent types of "bright" tobaccos—those of the lemon and other bright yellow colours. These and the types known as bright and dark mahogany are the sorts in greatest demand, selling at the highest prices in the markets of the world.

Before entering into the general subject, let me point specifically to one very important feature of tobacco-growing that is now being recognised, and it is worth the close study of every grower. I allude to the matter of planting too large a crop. Many beginners start out with more of a crop than they can give due attention to, and the result is inferior tobacco, low prices, discouragement, disgust, and a discontinuance of the business.

It is the small farmer with his few acres who makes money on tobacco, or at least the farmer who plants no more than he can handle expeditiously and well, in every stage of culture from planting to marketing.

The principle that underlies this policy is at once apparent—quality rather than quantity. To illustrate clearly and forcibly the importance and value of this "point," I will relate what I saw in a Virginnia tobacco warehouse only a few months ago. Many waggon loads of tobacco were driven into the warehouse, and the tobacco properly piled on the floor to await the auctioneer and buyers, this being the common mode of selling tobacco in the Southern States. Most of the piles were common, inferior, and nondescript, and sold at prices ranging from 1d. to 6d. per lb.; but there was one noticeable exception. A young farmer, from the same neighbourhood as the others, placed on the floor and sold 2,000 lb. of beautiful, bright, *whole* leaf at from 40 to 50 cents., or (say) 2s. per lb., his waggon-load yielding him more than 850 dollars, equivalent to about £170 sterling. Inquiry developed the fact that he had at home two more loads, most of it of equally good quality as that sold, all grown on 5 acres of land. He had given the crop his close personal attention from start to finish. Very many farmers, with their 20 to 25 acres, got less money for their crops than did this progressive young farmer from his 5 acres. Two acres, well cultivated and properly cured, will bring more money than 10 badly managed.

It is a well-settled maxim that tobacco is a crop that will not tolerate neglect at any time during the various processes through which it must go. It must not suffer any backset if it is to reach reasonably perfect maturity. Once set in the open field it must not be permitted to stop growing. Delays in its cultivation when it needs the work of the plough, cultivator, or hoe, work injury from which it never fully recovers, even with the best of subsequent treatment. Worms and other insects must not be permitted to eat holes in the leaves, else they are spoiled as wrappers, which, if entirely whole, sell at the highest price in all the markets. Literally, every plant in the field should be a pet plant, if the best results are aimed at. It is easier, and more profitable, to bestow painstaking hand-work in nursing carefully each and every plant on 2, 3, 5, or 10 acres than to distribute the labour-force of the farm over large fields, where the real cultivation of the tobacco—worming, hoeing, straightening-up, topping, suckering, &c.—is almost sure to be neglected or imperfectly done. In other words, it is easier, less expensive, and in every way more satisfactory to raise a pound of 1s. or 2s. tobacco, that "goes" as soon as shown in the market, than four to six times the quantity of 3d. and 2d. stuff that you are ashamed to offer in open market, and which the buyer partly confiscates because it is "very poor tobacco."

Suitable Tobacco Soils.

It is well known to all intelligent tobacco-growers that a light, friable, gray, sandy or gravelly soil, with a porous yellow subsoil is *the* soil for bright yellow tobacco—suitable for cigarettes, fancy plug wrappers, granulated smokers, and various other uses in manufacturing. The soil at the Moonbi experiment farm very nearly possesses the above qualifications, and will produce an excellent tobacco of the above type.

I would mention, however, that the famous "gold-leaf" tobacco of North Carolina, which sets the mark for all other bright tobaccos, is grown on very white, light, and *poor* soils, containing from 80 to 95 per cent. of sand. The yield per acre is small, viz., from 350 to 500 lb., but the product sells always at fancy prices, more than compensating for the small yield in pounds avoirdupois.

While Moonbi, and much of the soil near Tamworth, will produce fine bright tobacco, there are even better soils for this type in other places in the province. I have noticed very fine bright tobacco soil in the city of Sydney, about Waverley, and am credibly informed that there are large areas of such soil in various parts of Cumberland county. Doubtless there is much such land in various sections of the province. In the vicinity of Bathurst there are considerable areas of excellent tobacco lands.

Dark, very rich, heavy, mucky soils produce coarse, large-ribbed, heavy tobacco that cures dark, sometimes almost black. We find such soil at Nemingha, and cannot recommend it for tobacco, unless that specific type of goods is wanted.

The colour and character of the tobacco will always vary with the colour and texture of the soil, barring differences that may result from different conditions or degrees of skill in curing. Under like conditions of weather, &c., a skilful curer will make a much finer tobacco of the product of a bad soil than will the curer who does not understand his business well. Thus it may sometimes occur that the soil is charged with what the curer is really responsible for. Some medium soils, rather dark in colour, brown or chocolate, but deep and in fine tilth, may produce a really good article, suitable

for plug-fillers or dark smoking tobacco, such as is largely used in this Colony. Such tobaccos, however, are not likely to be very profitable to the farmer. The tobacco calculated to pay well is the bright yellow type.

It is a mistake to assume that the soil must be very rich to produce fine tobacco. In one particular, the reverse is the case. If the soil is supplied very liberally with nitrogenous manure or fertiliser, the tendency is toward too rank a growth, coarseness, and large veins, which are objectionable in all cases. Potash lime and phosphoric acid are the main ingredients of a good tobacco fertiliser, coupled with a good supply of vegetable matter to keep the soil open and porous.

In this article, I am dealing with well-settled principles and practice in the culture of tobacco, and indulging in nothing theoretical. If the foregoing outline of the essentials in the culture of the "weed" be doctrinally correct, the application of them in the soils already described, which are unquestionably well adapted to the growth of fine tobacco, then there is no apparent reason why New South Wales should not soon build up a tobacco industry that will add largely to her export trade, as well as supply the home consumption. Curing and fermenting the product can be done here as well as anywhere once the farmers "catch on" to the few simple arts of handling it properly and at the right time. Furthermore, the leaf once properly cured, can be manufactured here as well as in other countries. With the farmer, as well as the manufacturer, artificial means for securing the necessary humidity, when needed, are easily available in properly-built barns and packing houses, by the use of the steam jet or the cauldron of boiling water, or by saturating straw upon the floor of the building. There is no need of waiting for a rainy season to bring the hanging tobacco to "order."

Diligent and studious effort will soon clear away the blinding obstacles that loom up before the beginner at first. The experience of the farmers of New South Wales is only a repetition of that of their preceding English-speaking cousins of Virginia and the Carolinas some hundreds of years ago. Taking the cue from the wild untutored Indian who cured his tobacco by hanging it on bushes and the limbs of trees, the pioneer Americans began improvements by using first sheds, next open log houses, next closely chinked barns and so on, until a superior aromatic tobacco was produced, and a most profitable industry built up. The present generation of people the world over have better opportunities for learning the business, reaping the benefits of man's advanced knowledge of the science and art of producing desirable tobacco.

Requisite Climatic Conditions.

The tobacco crop requires a moderate, but not excessive amount of moisture in the soil. A wet soil produces coarse tobacco that cannot be cured bright. So leafy a plant, from which there is necessarily considerable evaporation through the pores of the leaves, calls, of course, for "good growing weather," but the saturation of the soil for a lengthened period is more injurious to the quality of the leaf than a moderate drought. Saturation excludes air from the soil interstices. Air in the soil, supplying oxygen, is necessary to uninterrupted and perfect cellular development, which is essential to the production of fine leaf. Hence heavy, clayey soils, which are very retentive of moisture, are unsuitable for the finer types of tobacco, and should be well drained, even for dark, heavy leaf. In regions subject to drought it is important to plough deep, as elsewhere suggested, to induce the roots of the plant to penetrate downward into the moister strata of soil. The deep

placing and covering of manures or fertilizers also has this effect. The roots seek and go to the deeply placed manure, as has been proved by ample experiments.

From these facts it is clear that a moderately dry season is preferable to a wet one for the production of fine yellow tobacco. The tobacco plant produces leaves of the richest flavour under a tropical or sub-tropical sun, as in Cuba and Florida, if grown in the proper soils. The lack of sufficient rainfall is largely, and in many instances completely overcome by the liberal use of vegetable matter, which absorbs and holds moisture in proper degree, and by deep preparatory cultivation, which induces deep rooting, and the capillary attraction of water from the lower depths of soil. There can be no doubt that intelligent culture in these respects will master the situation in tobacco culture in areas of reasonable rainfall. In seasons of excessive precipitation ample drainage is the needful thing, and in the arid regions, in good tobacco soils, irrigation will supply the one lacking element of an ideal tobacco climate.

A merely cursory discussion of the leading features of the industry may serve as pointers to the uninitiated in time for the present season's operations.

The Rearing of Plants.

The most suitable place for the plant-bed is a rich spot of ground in the open woods near the field in which the tobacco is to be grown. A sunny slope should be selected, if available, so that the plants will get as much sunshine during the day as possible. The bed should not be shaded by trees. Plants thrive better in a virgin soil, and such a place is apt to be comparatively free of grass and weed seeds and destructive insects. A plot in the cultivated field will answer if these pests have not possession of the soil. In either case, pile wood—logs, brush, and combustible matter of any sort—over the plot, sufficient in burning to heat the soil well 2 inches deep. See that every part of the bed is heated. Let the fire burn down completely, supplying more fuel where needed. When the bed has cooled rake clean, leaving the ashes, and dig up the soil thoroughly to a reasonable depth, raking and pulverising the bed till in the finest condition. Dig in and thoroughly incorporate with the soil a liberal quantity of well-rotted finely pulverized stable manure that has gone through fermentation sufficient to kill all grass and weed seeds; or use a good commercial fertiliser, or manure that has been composted. Make the bed rich without introducing noxious weeds and grass. If there is danger of an invasion of destructive insects, or if there is likelihood of frost, the beds should be boarded in on all sides and covered at night with cheap cotton cloth tacked to a suitable frame. If there is no danger of either of these troubles it is better that the bed be left exposed, as the plants will grow hardier, stronger and faster exposed to the open air and sun. Have the surface of the bed level, that is, conforming to the contour of the slope, with no depressions, so that water will not lie on it when it rains. Do not sow too much seed. It is better to prepare more beds and sow the seed thinly than to have the plants too thick, in which case they grow "spindling," and will be weak and sickly. The result of this will be seen in the loss of plants in the field, and in slow growth. Grown thinly in the bed, they will be stout and stocky, and will grow off at once when transplanted. Sow not exceeding a level tablespoonful of seed to the square rod of bed. This will be about 60,000 seeds to that area. All will not "come up" and make plants, but the plants will be quite thick in the bed. After they have grown up

sufficiently to be grasped between the thumb and forefinger, thin them out where they are too thick. Nearer together than one plant to the square inch is undue crowding. There is nothing more important in growing a crop of tobacco than to have stout healthy plants to start with. The farmer may think all this work unnecessary, but it will be found very profitable in the end. Be sure of a sufficient supply of stout, hardy plants, without having to use the small inferior ones. In sowing the seed mix them thoroughly with 3 or 4 quarts of some white substance that can be seen on the surface of the ground, such as clean ashes or slaked lime. This will aid the sower to an even or regular distribution of the seed over the bed. Cornmeal is often used for the purpose. Do not rake the bed after sowing, but sweep it very lightly with a house broom, and then pack by rolling, by placing a plank across the bed and walking on it, moving the plank a little less than its width at each tramping. The bed should then be liberally watered with sprinkling pot of fine apertures, or the spraying-machine. The bed should be watched from day to day and not be permitted to dry out. When the young plants appear they should be frequently sprinkled with weak liquid manure or water. By no means ever let them suffer for the want of water. It is a matter of great importance in tobacco-culture to keep the plants growing continuously.

Preparation of the Soil.

No intelligent farmer need be told that the soil for tobacco should be broken deeply and well pulverised. The rows should be laid off $3\frac{1}{2}$ feet apart. Narrower rows will make cultivation with the plough tedious. The first furrow, over which the plants are to be set, should be subsoiled without bringing the subsoil to the surface. It has been demonstrated that where this is done the main or tap-root will strike deeper, and thus render the plant more independent of drought. Into this furrow drill whatever fertiliser is to be used, and lap on four furrows with a one-horse turn plough. Just before transplanting attach a block of wood to the plough foot and run it lightly over the rows to smooth the top of the ridge. Next follows the "patting" of places where the plants are to be set. This is done with the back of the hoe, the object being to place the "hills" at the regular distance apart, and to facilitate rapid work in dropping and transplanting. The distance between the plants varies according to the size of the variety, from $2\frac{1}{2}$ to 3 feet. When fertilisers are not to be used in the drill, some farmers prefer to lay off the rows with a long, deep-cutting, narrow plough, and plant in the shallow furrow thus made, on the common level, as level culture conserves moisture better than ridges, owing to decreased exposed surface.

Transplanting.

Transplanting is usually done when the plants in the bed are 4 to 6 inches high, with largest leaves 3 inches in diameter. It is not best to transplant when plants are very young and tender. They "take" better when four or five leaves high, and when they have become strong and stocky. The bed should be thoroughly watered before the plants are drawn, to soften the soil and make them draw easily without bruising or breaking the roots. If there is any difficulty in getting them up easily, the use of a trowel will facilitate the work. It should be endeavoured to have the plants as nearly of one size as possible when they are set, the purpose being to have an even growth and even ripening. The plants, after drawing, should be exposed to

the sun as little as possible before planting. They should be placed evenly in baskets and kept shaded, and the dropper should not proceed more than a few hills ahead of the planter if the sun is shining, thus limiting the exposure of the plant to the sun's rays to a minute or so. The planter starts with an extra plant in his hand, which he plants in the first hill or "pat," picking up the one the dropper has dropped as he goes to the next hill. In this moment of passing from one hill to another he adjusts the plant in hand ready for insertion into the hole he promptly makes with the dibber, a wooden peg of suitable length sharpened at one end. There is no better utensil than this for rapid and perfect transplanting. It is inserted into the patted place to the proper depth, conforming to the length of the root of the plant, which, being ready in the planter's left hand, is inserted as the dibber is withdrawn. The dibber is then thrust into the soil several times immediately around the plant pressing the soil to the root, which operation is aided by the fingers or fist of the left hand. The plants should be set fully as deep if not slightly deeper than they grew in the plant-bed. Be sure that the ends of the roots are not doubled upward in the bottom of the hole. If the weather and soil be dry, and the plants are to be watered, a depression and a few dibber holes should be left close to the root to receive the water, which, as soon as it is absorbed by the soil, should be covered under with dry earth drawn up around the plant with the hand or a small hoe. This dry earth acts as a mulch to prevent the water from evaporating, and also to avoid the formation of a hard clod or crust around the root. If the soil be in good condition, and at all moist, no further watering will be necessary. Indeed, if there is a "season in the ground" no watering is necessary in the first instance. Where the plants are watered, the water serves to settle the soil to the root and make the plants feel at home in their new quarters. Where they are not watered, however, it should be made sure that the soil is well pressed to the roots. This is best done by the firm pressure of the foot on at least two sides of the plant, and near the stem. Bad stands are often the result of carelessness in this respect. Many plants die because the roots are not in firm contact with the soil.

Cultivation.

As soon as the plants show signs of having struck new root, and stand up sprightly, the cultivation should begin. The first working should be with the hoe immediately around the plant, loosening up the soil well without disturbing the root. A marked improvement in the plants will be noticed immediately following this working. The cultivation should be kept up with promptness during the growing-season with plough, cultivator, and hoe. The first plowing, when the plants are quite young, may be tolerably deep and near the plants, but future cultivation should be shallow, merely surface stirring. No intelligent farmer need be told how to do the work, but the suggestion may be emphasised that no crop responds more readily to frequent and clean cultivation than tobacco. The plants must be kept growing continuously by this means. To neglect the crop in this particular is to curtail the yield and to really injure the quality of the product. The last working should be the drawing of earth around the stems of the plants with the hoe, and straightening up all that do not stand upright.

Pruning the Plants.

The most successful tobacco-growers, as a rule, top the plants as soon as any considerable number of seed-heads have lengthened up, so that the

desired number of leaves to be left can be easily counted from the bottom. Priming, that is, taking off the worthless bottom leaves, is done, if at all, along with topping.

In the United States no branch of tobacco-culture excites so much debate as the question of how many leaves should be left to the stalk to secure the best results. The wide divergence of opinion and practice, between men who are regarded as leaders in tobacco-culture, is curious and amusing. A. contends that only the flower-bud should be removed, and everyone of the plant's usual twenty-two leaves should be left to mature. B. tops down to ten or twelve leaves, and C. "splits the difference" with from fifteen to eighteen. The majority of opinion favours from twelve to fifteen leaves according to the fertility of the soil and thrifty or backward condition of the crop.

It can hardly be doubted that the fewer the leaves left to ripen, within certain limits, the greater the development and the richer and sweeter the tobacco. Against this point is urged that of large ribs and veins in the enlarged highly developed leaf, and a heavier coarser tobacco.

In this matter the farmer must be guided by experience and his own judgment, considering the type of tobacco he intends to produce. If heavy plug tobacco, the larger ribs are not so objectionable, as such tobaccos are in all cases carefully stemmed in the process of manufacturing. If cigarette tobacco is the object, a larger number of leaves may be matured, with a view to producing a brighter, thinner, and lighter textured leaf.

Topping is done by pinching out the top of the stem with the flower-bud, at the desired height, with thumb and forefinger. To quickly arrive at the place of severance, fix the eye on the lowest good leaf, ignoring the bottom or sand leaves if they have not been primed off, and for every leaf directly over such lowest good leaf count three. Thus four leaves directly over each other make twelve, or five fifteen, including both the bottom and top leaves in the lot. This method obviates the slow process of counting, and greatly expedites the work of topping.

As to priming off the trashy, small, bottom leaves, growers differ in opinion and practice. It is contended on the one hand that priming injures the plant, and on the other that it beneficially lets in the sun to warm the soil around the plant, and increases the supply of sap for the leaves above. In the writer's opinion it makes little or no difference whether priming is practised or not. These bottom leaves reach maturity, turn yellow, and cease to consume plant food early, and they in a considerable measure protect the upper leaves from sand during hard showers of rain. The best of them may be cured into a cheap grade of smoking tobacco.

Immediately following topping the suckers or lateral shoots spring forth at the axils of the leaves. These must be pinched out promptly while young and tender, as they soon become woody and cannot be removed without injury to the plant. Suckering the plants requires to be done at least twice, but rarely oftener.

Combating Insects.

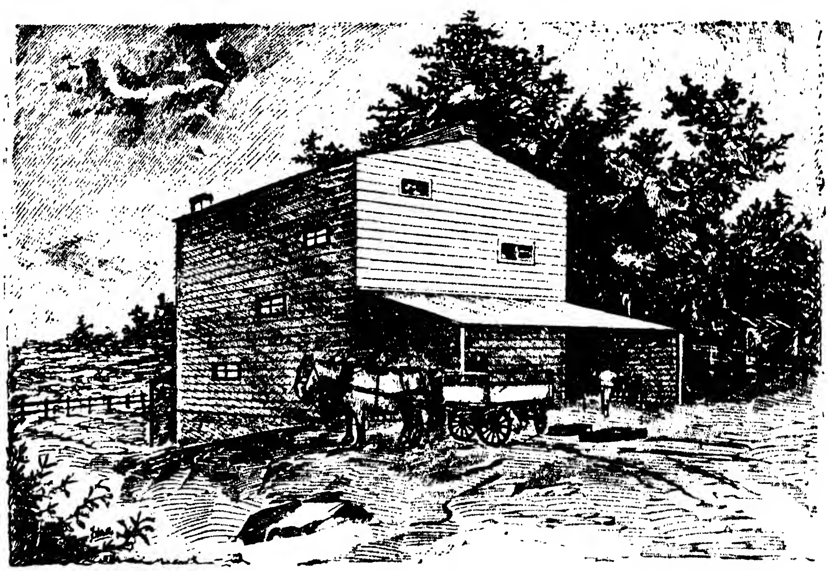
Destructive insects of every kind that prey upon the leaves of the plants are most easily conquered by the use of insecticides applied with the knapsack sprayer. The Vermorel nozzle is perhaps the best in use, making a spray as fine as mist, reaching every part of the plant. What is termed an "under-sprayer" should be used. With this the nozzle can be placed on or near the ground and the spray thrown upward, thus reaching the under surface of the leaves where insects are wont to lurk.

For leaf-eating or masticating insects or larvæ use Paris green or London purple at the rate of one pound to 200 gallons of water. Spray every part of the plant thoroughly as soon as the first worms appear, and again upon their reappearance later on, for which a strict watch should be kept up. There is no danger in the use of these poisons provided the spraying is discontinued a few weeks before the tobacco is harvested. It has been demonstrated beyond question that they are dissipated by rain, dew, and atmospheric action within a short time after being applied. The old slow and tedious and imperfect method of picking off and destroying worms by hand will not be continued by anyone who has once tried the spraying machine.

For all sap-sucking pests, such as the aphis and other small insects, use the kerosene emulsion, directions for the preparation of which have often been published, and which can be had upon application to the Department of Agriculture. This mixture kills by contact only, as it is not eaten by the insects in sucking the sap; while in the case of masticating worms, &c., they consume the green or purple with their food, and the minutest quantity destroys them.

Curing-barns.

The curing-house, if not already provided, must be gotten ready while the crop is growing. Omitting for the present a description of the old-fashioned, closely-built and chinked log barn of Virginia and the Carolinas, I venture



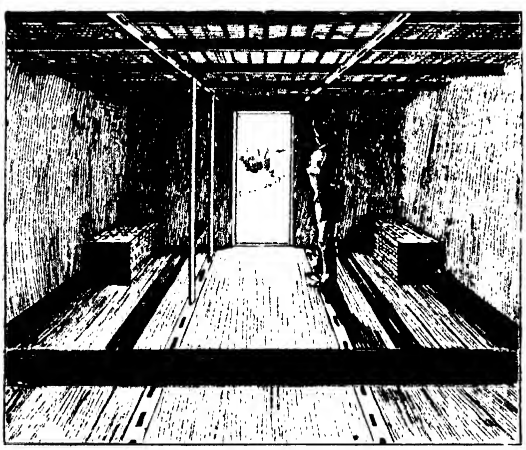
The Improved Modern Barn.

to say that the best curing-barn for the climate of New South Wales is one built as compactly as possible of brick, concrete, or mud, in which the coolest temperature available can be maintained. This is not that a cool temperature

is desired for curing tobacco, but because in such a barn something like evenness of temperature can be secured, and the fire-heat afforded through flues controlled independently of the temperature of the outside atmosphere. To properly cure bright tobacco the temperature inside the barn must be under the control of the curer. This cannot be accomplished under corrugated iron or in any structure other than one that is normally cool and not subject to the influence and changes of the outside weather. The ideal building meeting this requirement, to the writer's view, would be built of stone, mud, or concrete, on the shady side of a steep hill-slope. A suitable barn may be tightly built of stout lumber in a similar situation, and cellared into the hillside half or all its length, if necessary, to get a cool and steady temperature. With this secured, any desired degree of heat can be applied.

Any kind of barn in any situation must be provided with ample ventilators in the top and sides, so fixed as to be quickly available when conditions call for their use.

Flue-curing is now the most approved method of curing fine tobaccos of every type, but more especially the lemon yellow. Two small furnaces of brick or stone are built through the wall of the barn, one on each side of the entrance door. The usual size of these is 18 inches wide and deep, and about



INTERIOR OF BASEMENT.

6 feet long. They should project 15 inches outside the wall. The fires are fed with good dry wood from the outside. Large stoves may be used instead, but they are more costly. From the furnaces or stoves 10 or 12 in. sheet-iron pipes, provided with dampers, are run with a gradual rise to within 2 or 3 feet of the rear wall, whence they are elbowed into a larger return-pipe in the centre of the room, or each may return separately, through exits about 3 feet above the floor near the door. The outfit is not expensive and may be fitted up in good order by any ordinary mechanic, or by the farmer himself.

What is known as the leaf-cure process is without doubt the better method of curing tobacco, as contradistinguished from that of cutting and curing the whole stalk at one time. The leaves are gathered from the stalks in the field as they ripen, and ripe leaves only are permitted to enter the barn. The advantages of the system are easy to see. At no time are all the leaves on a plant in like condition of development and ripeness. Curing the whole stalk at one time means four or five types and colours with much green, bitter tobacco, whereas by the leaf-cure process almost perfect uniformity in colour and quality is attained. The ripe leaves are strung on wire points on what is known as the wire-stick, and are cured in about four days. Usually by the fifth or sixth day the barn may be emptied to make room for successive curings, as the leaves on the plants ripen. The improved modern barn, measuring 16 feet wide, 20 feet long, and 20 feet high inside the curing-room, will hold 728 wired sticks of fourteen points each, aggregating 10,192 points. These points project 6 inches out on each side of the stick. If each point is made to carry eight leaves, $\frac{3}{4}$ of an inch apart, the barn will contain 81,536 leaves at each curing. An acre of 5,000 plants of fifteen leaves each produces 75,000 leaves. It is seen, therefore, that the equivalent of (say) an acre of tobacco may be cured at one time, or (say) every week, which amounts to curing the product of 8 acres in (say) eight weeks.

But this is proceeding too slowly, and is excusable only under very unfavourable conditions—continued wet weather and very sappy plants. With clear dry weather the barn may be emptied and refilled every five days. Again, under such favourable conditions, ten or twelve leaves may be cured upon each wire-point, which increases the capacity of the barn to 102,000 or 122,000 leaves, or the equivalent of $1\frac{1}{3}$ to more than $1\frac{1}{2}$ acre per curing. At this maximum rate of speed, eleven curings, or the product of 15 acres, may be accomplished in eight weeks. This result is entirely feasible, unless the crop is a late one and the approach of frost compels a resort to the stalk-cure process to save and make the best that can be made of what is yet in the field.

Such a rapid pace contemplates uninterrupted progress throughout, with an abundance of help and no delays from any cause. A safer calculation with beginners would be 10 acres of tobacco for a barn of the above dimensions.

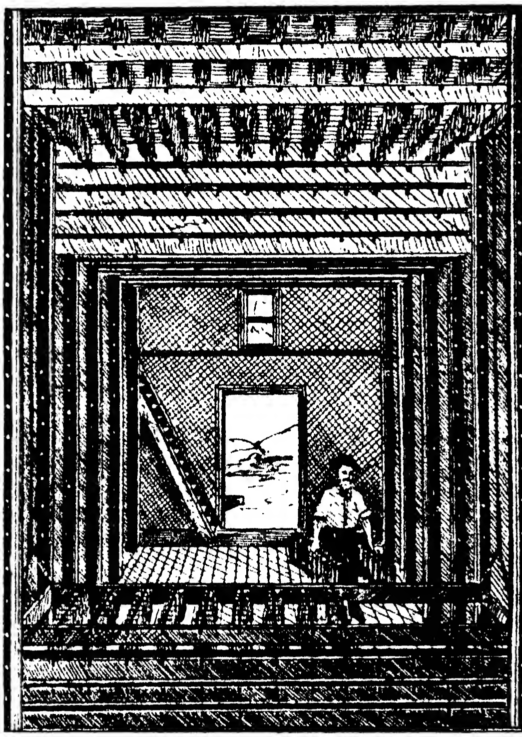
The shift to the stalk-cure method, however, as above mentioned, may be always kept in view as a *dernier ressort* for saving and curing the last or top part of the crop into valuable tobacco, the earlier leaf curings having taken care of the main and superior leaves.

The wire stick is a cheap affair, readily made by any sensible farm hand. They may be made any desired length of 1 or $1\frac{1}{4}$-inch lumber, having regard to the distance apart of the tier poles upon which they are to rest—4 or 5 feet, as the barn is divided into sections. Bit-holes are bored through the wood 6 inches apart, and through these the pointed wires, 9 inches long, are inserted, doubled over, and hammered down securely. Stout galvanised wire is used.

The curing by this process begins early—as soon as the first bottom leaves ripen—and is kept up continuously till the whole crop is cured. When the work of cutting and housing first begins with the stalk-cure system, the leaf-curer may have half his crop cured and bulked down, and almost ready for market, with no stripping and very little grading to do, the latter having been practically done in the harvesting and hanging.

This barn is built in two apartments—a brick or stone basement beneath—in the side of a hill-slope, containing the furnaces or stoves and heating-flues,

and the curing-room above 20 x 16 x 20 feet. Between the two there is a loosely laid floor, through the 1¼-inch crevices of which the heat rises from below and passes upward through the tobacco and out through the roof. A clear understanding of the plan of the barn will be had by a careful study of the



THE CURING ROOM.

accompanying diagrams. It will be seen that the sticks of tobacco are placed on racks, fifty-two in number, there being thirteen directly over each other in each of the four 5-foot sections of the barn. These racks are filled on the floor and drawn up to their proper position by rope and pulley, and safely pinned in the stanchion-frames.

The Modified Modern Barn.

This plan of barn may be modified to suit the notions and convenience of the tobacco-grower. Many planters in the States have only one room, doing away with the intervening floor, and providing cross-beams or joists 1½ or 2 feet above each other, on which the sticks of tobacco are placed, stalk-cure fashion, 15 inches apart. This modification of course places the tobacco and flues in the same room, and necessarily decreases the space for hanging tobacco, as the lowest tier should not hang nearer than 6 feet above the flues. In such case it is advisable to make the barn larger, say, 20 x 25

or 25 x 30 feet. The cost of the barn is a question of arithmetic, and is best estimated by the builder, according to the facilities at hand. It is an easy matter for anyone to calculate how many 5-foot sticks of tobacco any size barn will hold, placing them 18 inches above each other and 15 inches apart in the tier. With intelligent planning the farmer will, on the foregoing bases, plant an acreage according to the barn-room at his command, or provide barn-room according to the area he has planted or intends to plant, keeping in mind the question of how many leaves he will allot to each plant in topping—a greater number for thin-leaved bright tobacco and fewer for the dark, heavier types.

Quite an improvement is made in the above-described modified barn, recovering the lost space referred to, by excavating to the depth of 6 or 7 feet in the centre. This excavation takes the place of the basement in the improved modern barn previously described. By this means the furnaces and flues are placed so far below the level of the ground, and the fires out of the reach of the winds, and the entire space above the earth-level is devoted to hanging and curing. Another advantage gained by it is that moisture is more easily supplied from this underground compartment for bringing the tobacco into order for handling. But the chief value of this improvement lies in avoiding the necessity of an enlarged building, thus greatly reducing the cost of the structure, and bringing the whole arrangement into a smaller compass.

Experience teaches that it is of the utmost importance that tobacco should not be harvested when wet with dew or rain, and that the barnful should be gathered and hung all on the same day—within twelve hours—and the fires started as soon as the barn is full. The portions harvested on separate days will cure differently in colour. Hence, the popularity of small barns that can be filled in a working day.

A great advantage gained by the leaf-cure method in preference to the other lies in the utilisation of a cheaper class of labour for the light work required—that of women and children. A girl or boy 10 years of age will stick as much tobacco in a given time as a grown man will; and with a little training the smarter ones will soon learn to distinguish the pale-green, yellowish ripe leaves from those that are not yet matured. They will likewise soon become adepts in assorting the leaves according to size, length, and quality in sticking, which reduces the work of grading after curing to little else than a careful inspection of the tobacco, with little culling or classifying.

At first thought some farmers will regard this gathering of the ripe leaves from the stalks as they stand in the field as a very irksome and arduous task, entailing no end of tedious work. This error will at once appear, however, when it is remembered that the really more irksome task of stripping from the stalk and grading into four or five lots after curing is avoided, and the tobacco put directly into bulk from the curing-barn. The time saved, too, is a matter of very considerable importance, as the tobacco, or at least all of the early curings, if not all of the best of the crop, will be bulked in time to go through the necessary fermentation, or "May sweat," as it is termed in America, before the warm season has passed. Thus it is, as has been well said by a leading advocate of the leaf-cure process, that the leaf-curer is handling his money while the stalk-curer is yet handling his tobacco. If the proper fermentation of the leaf can be accomplished shortly after it is removed from the curing-barn the tobacco is so much the earlier brought into condition for market, export, or manufacture. The atmospheric

temperature necessary to promote such fermentation continues in New South Wales, it seems, long after the ripening and curing of at least the main portion of the crop.

String-curing.

The method of stringing the tobacco leaves on twine is more tedious and unsatisfactory than that of suspending them upon wire points. In many instances the twine will sag to such an extent as to too closely bunch the leaves together, preventing the free circulation of air between them as afforded by the unyielding wire. If the leaves do not hang separately, or if parts of them lie in continuous contact, discolourations are apt to result, especially when the curing is done during damp weather. Many leaves, in such cases, will present several shades of colour, which curtails their value. Neither is the work of hanging done so expeditiously and conveniently as by the wire-stick, which, being fixed in forks under the projecting shed at the door of the barn, is held steadily in place, enabling the operator to use both hands freely in sticking. As fast as the sticks are filled with leaves they are caught in the middle and elevated to any height in the barn to the hand of the hanger, by rope and pulley. It is at once seen that the wire-stick is the more convenient arrangement for sticking, hoisting, and taking down the tobacco, as well as for transferring it to the packing-house, disengaging, assorting or grading, and tying it into hands.

Curing on the Stalk.

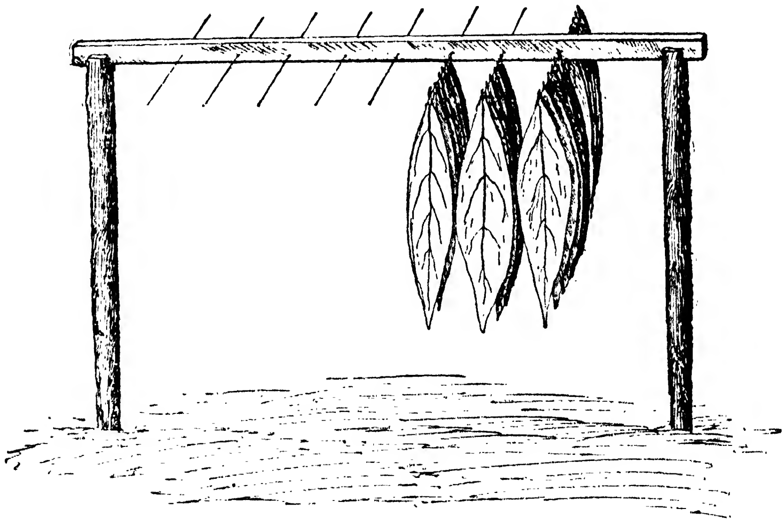
Those who, for sufficient reasons, adhere to the method of cutting and curing the entire plant in one operation will find that flue-curing is none the less efficient and valuable, ensuring a better though variable product, and in shorter time, than can ever be turned out by air-curing. The principles involved are identical in either the leaf or stalk cure, the chief faults of the latter being that by it many entirely green (unripe) leaves are necessarily gathered and cured along with the ripe, producing an inferior tobacco, necessitating a vast deal of careful grading by skilled hands, and prolonging the whole process for weeks, and even months. The cheap labour available for the leaf-cure method cannot be employed in this case.

The manner of cutting, curing, and handling tobacco on the entire stalk involves nothing essentially different from the other methods, except in particulars already pointed out. The process is slower on the whole, and fully as expensive, if not more so, in the end, to say nothing of the large quantities of inferior tobacco produced, which the leaf-cure would have very greatly improved in quality and price.

Methods of Hanging.

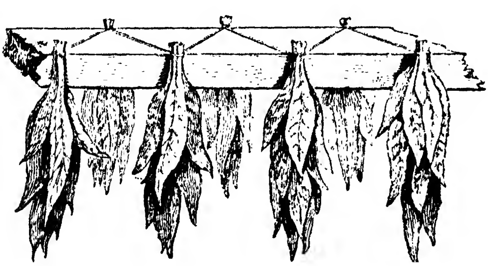
There are various ways of cutting and hanging tobacco by this system. Some split down the stalks to within 3 inches of the ground, and cut below the slit, straddling the stalks on the plain lath-sticks. Others cut the stalk whole, and placing a movable sharp-pointed "spear" over one end of the stick, which is tapered, force the same through the butt end of the stalk. To do this conveniently the other end of the stick is placed in a slightly slanting auger-hole in a convenient post or tree. Pegging is another means employed in some American localities. Pointed hardwood pegs 6 inches long and ½-inch thick are driven with a mallet into the stalk about 4 inches from

the butt, slightly slanting so as to hook well over the stick. The peg holds the plant securely upon the stick. Pegged plants are hoisted on a "horse," which is made by nailing three short sticks together in a triangle. Upon



this the plants are hooked by the pegs and drawn up by rope and pulley to the hanger, who transfers them to sticks on the joists.

A fourth method of hanging the plants is that of tying them to the joists or tier-poles with strong hemp twine. The first plant is tied at the end of the pole on one side, and the next one on the opposite side, and so on, alternating the plants zig-zag from side to side every 6 or 8 inches for the full length of the pole. The twine is wrapped, not tied, firmly around the butt of each plant after the first, and passed taut to the next one without severance. The work is rapidly done by a quick hand—the plants being handed up from below as fast as wanted. By this method sticks of no kind are necessary. This plan of hanging tobacco does not interfere with the splitting of the stalk already mentioned.



There are earnest advocates of each of these methods of hanging among those who have not yet abandoned the stalk-curing process. Splitting down the plants is an advantageous practice, in that it expedites the drying out of the stalk, which, until dried out, imparts moisture to the midribs of the leaves for some time, and thus prolongs curing.

The barn for stalk-curing tobacco need not be materially different from any other in construction, except that the joists (tier-poles) must be farther apart vertically. Three feet above each other is the usual distance.

An antiquated idea prevails with not a few American tobacco-growers of the old school that the stalk supplies some necessary element of richness and flavour to the leaf while being cured, and that the separation of stalk and leaf is therefore injurious to the quality of the product. It may be said, however, that this primitive notion finds no acceptance with many of the most successful growers of the present time. It is believed by many, and it is doubtless true, that the presence of the sap-laden stalk is an injury to the leaf, imparting bitter and disagreeable properties rather than anything beneficial. It is better that the stalks remain in the field and be chopped down and ploughed under for the benefit of the soil and its future crops.

The Curing Process.

The curing of tobacco, viewed from a scientific standpoint, is not thoroughly understood by anyone. The thing for the inexperienced farmer to do is to learn how to cure, in a matter-of-fact, practical way, adopting as far as possible the methods and practices of successful growers in sections and countries where excellent tobaccos are produced. To become imbued with the idea that curing tobacco is a mysterious art, requiring the acquisition of imaginary secrets and a knowledge of the scientific side of the business, is to invite confusion and hinder the successful prosecution of the work. It is proper and profitable that one should learn all that can be learned of the business he follows, and a grain of true philosophy throws a flood of light on matters not previously understood, except in practice. True theory, the tracing of the connection between cause and effect, opens the way to a clear and correct understanding of any business, but it is hazardous and often disastrous to proceed upon an unproved theory.

Most of what is known of tobacco culture and curing is the outcome of the experience of practical farmers through long years of trial on the part of many generations of people. Science has recently taken hold of the subject and is fast clearing away the cobwebs of ignorance, but it stands to the credit of the practical, zealous farmer that it has been by his patient and long-continued efforts that the best progress has been made. With the aid of science now enlisted, however, much greater progress in the immediate future may be confidently expected. The methods and practices of to-day, the growing of the plant, the barn and much of the work of handling and manipulating, are all more or less primitive, in a comparative sense. The farmer of the near future will offer a better article of tobacco than is now produced, the manufacturer will improve his processes and supply the public with more acceptable, agreeable, and less poisonous goods, and consumers will welcome the change from a bad and sickening to a delicious and wholesome smoke or chew.

The curing of tobacco is described by eminent authority as a life process. Life in the plant-cells is not extinct until the leaf has been completely killed by fire-heat or long-continued exposure to atmospheric influences. Certain it is that important changes in the constituent elements of the leaf take place during the process of curing, the analysis of the cured leaf showing different properties and compounds to those of the same leaf in its green state.

The mere drying of the leaf—the expulsion of the water it contains—is not curing it, in the well-understood meaning of the term. This evaporation of the water takes place slowly, and during the process changes occur that

some writers treat of as a species of fermentation. Whether or not that is the correct definition of the phenomena, it will not be incorrect for the farmer to regard it as the final *ripening* of the leaf, the same as the complete ripening of the peach, pear, or apple in storage, after it has been taken from the tree in a half-ripe state. In this stage of complete ripeness the fruit or the tobacco-leaf is at its best, so far as its constituent elements go to bring it to maximum maturity and sweetness. Further change is towards dissolution and decay, but there is no further change at this juncture if the water, which has heretofore facilitated change, now disappears, leaving the leaf in a dry state. During the procees there is a change of colour—only nature's change hastened—from green to yellow.

To secure and permanently hold this colour is the desideratum of the bright-tobacco grower. In bright, clear weather it is easily caught and fixed by the skilful and careful curer; but in moist murky weather it is more difficult, as under such conditions evaporation is retarded, and the steady, continual application of the process interfered with. In this case, the only course to pursue is to keep up steady fires and maintain in the barn the proper temperature, yet to be laid down, and give good ventilation in the roof only. Air holes on a level with the floor should also be kept open. By these means a continual upward draught of air is kept up, passing out through the roof. Evaporation will be slower, which may result in a less desirable colour, but it will be making the best of unfavourable conditions that cannot be bettered. The same tobacco in an open shed or other air-curing structure would suffer far greater injury under such conditions; and after all, the flue curer need not lose hope, for close watching and strict attention to the temperature and roof ventilation will in most cases turn out a superior yellow type of tobacco.

In this connection, it is not a waste of words to repeat and emphasise the importance of a very compactly-built curing-barn, that provides normally a cool temperature, and which may be tightly closed or freely ventilated at the will of the curer. Perhaps the cheapest way to provide such a building for this climate is to build it of mud. The roof should also be close and compact, but provided with ample ventilators with easy-moving shutters in the extreme top, and along its entire length. A shingle roof is the best. There would be great danger from sparks in the use of a thatched roof in fire or flue curing.

The great advantage—the all important advantage—of the barn above indicated lies in the fact that any desired degree of heat may be applied at any time, or the room cooled down promptly at the curer's command, even to some degrees cooler than the outside air. A mud or other earthen-walled building is suggested as affording effective resistance to the rays of the sun during very hot weather. Other means to this end may occur to the practical mind, such as packing of some sort between weather-boarding and ceiling.

Stalk-curing Bright Tobacco.

Following is the standard heat-formula commonly employed in the State of Virginia. It was first adopted and published by Major R. L. Ragland, of that State, who during a long experience followed the stalk-cure method, but who in the last years of his life endorsed leaf-curing as a great improvement upon old methods. This formula applies to the method of curing on the stalk:—

1. Yellowing process, 90° Fah., 24 to 30 hours.
2. Fixing colour, 100°, 4 hours.

3. Fixing colour, raise $2\frac{1}{2}^\circ$ every hour to 110°.
4. ,, raise gradually to 120° in 4 to 8 hours.
5. Curing the leaf, raise to 125° in 6 to 8 hours.
6. Curing stalk and stem, raise 5° an hour to 170°.

Continue at 170° until stalk and stem are thoroughly killed and dry—usually 12 to 15 hours.

It will be observed that 170 is a very high degree of heat for a barn of tobacco whose leaves are at the time dry. It is considered necessary to completely dry out the stalk in the climate of Virginia, which is, as a rule, more moist than that of New South Wales. In the dry climate of this province, such high degrees of heat will hardly be required, unless during a season of damp weather; 150° to 160° may be sufficient in fair weather.

The temperature and changes above recommended for "fixing colour" should be closely studied. The leaves are now yellow—the best of them of a uniform yellow—and the greener ones, or those not ripe when the plants were cut, a light pea-green. As the heat is advanced to fix colour there is a probability of the accumulation of sweat on the tobacco. If this sweat is not promptly dried off it will greatly injure the colour of the leaf, spotting it and changing it to red. Many barns of fine tobacco are ruined as "brights" by neglect at this critical period. The sweat is abated by opening the air-holes at the floor, or the door if necessary, and giving sufficient ventilation at the top of the barn, or even at the sides, if necessary.

The temperature should not be carried higher than 110° Fah. until the "tails" of the leaves begin to curl. The leaf is cured at 120°, and the midrib at 140°; which would complete the process were it not for the presence of the yet sappy stalk. This must be dried out perfectly or its moisture will soon flow into the leaf and stain and otherwise injure it.

By the system above given the ripe leaves of the plant produce superior tobacco, and many of the unripe ones, which have cured pea-green, will change to yellow when bulked. When the curing has been completed the tobacco should be ordered by applying water freely over the barn floor, or upon straw spread over the floor, taken down and loosely bulked, stalks included, in any dry house, to await stripping. The "ordering or "conditioning" by the above means is greatly hastened by gentle heat in the flues, which vaporises the water so applied in shorter time, and creates a humid atmosphere in the room.

It should be borne in mind that every time tobacco becomes moist and dries out again, after curing, its colour changes to a darker hue Hence the objection to hanging tobacco in a shed after it is cured, subjecting it to constant atmospheric changes; and hence the importance of getting it into bulk as soon as possible, and thus placing it beyond the reach of such influences. When bulked in proper condition there is no deterioration of colour.

The Single-leaf Cure.

In the leaf-cure method the fires are started as soon as the barn has been filled, and the desired degree of heat for the first thirty or thirty-six hours is from 85 to 90. In this time, in favourable weather, most of the leaves will have assumed a light pea-green colour. The heat is then advanced to 95°, and kept there two hours; then to 100° for three hours, to 105° for two hours, to 108° for two hours, to 112° three hours. During this twelve hours sweat is likely to occur, and it must be promptly dissipated by sufficient ventilation. The tails of the leaves should now show signs of curling up bright, but if they show dark lines the heat should be lowered to 105° for an hour, and then

raised 1 degree an hour till 120° is attained, remaining at that point until the leaf is cured. The next step is to raise the heat 2 degrees an hour to 140°, to cure the stems (mid-ribs) hard. When the stems throughout the barn have hardened so that they will snap when bent, the curing has been completed. The fires are now put out, all doors, windows, and ventilators thrown open, the floor well sprinkled with water, and the barn left open over night. The tobacco comes to order during the night, and is removed to the packing-house and bulked on the day following, but care must be taken that it is sufficiently soft before removing to prevent breaking, and not too moist. There is danger just here of bulking with too much moisture in the leaf, which will cause too great heat in the bulk and ruin the colour—lemon, if the curing has been properly done. The tobacco is in proper order or "case" when the leaf can be clasped in the hand and squeezed with but slight if any breakage of the fibres or lateral ribs, and the stem is hard and brittle.

The foregoing plan and procedure in leaf-curing is, in the main, that of Capt. W. H. Snow, of North Carolina, the inventor of the modern barn heretofore described, and a successful producer of fancy bright tobacco.

In the regulation of the temperature of the curing-barn in New South Wales, the tobacco-grower should rely mainly upon his own judgment rather than adopt as fixed rules the practices of others in other climes. Indeed fixed rules, suitable for all circumstances and conditions of weather, cannot be laid down in any country or for any class of tobacco. If there is much sap in the leaf or plant as the result of a moist season the yellowing will be harder to accomplish, because requiring a lower degree of heat to prevent scalding. On the other hand, if the plants or leaves are harvested during a season of dry weather, when they contain only a modicum of sap, the tobacco will bear a higher degree of heat (say 100°) to yellow promptly and well. In such cases the leaf is cured in about forty-eight hours and the final curing may be completed in less than three days, or about sixty-five hours. This is sometimes the case during seasons of drought in Virginia and Carolina, and similar conditions may oftener occur in New South Wales.

A new and more rapid process of yellowing tobacco has recently been put into practice. It is to warm up the tobacco for three hours at 90°, then advance the heat rapidly to 125°, letting it remain at that point only a few minutes, and by ventilation, turning the dampers, and decreasing the fires, drop back again to 90°. This sudden rise of the heat expands the sap-cells and starts the water to the surface, hastening evaporation and shortening the time required for yellowing. Those who try this quick "sapping" process should be very careful to lower the high heat promptly in a few minutes time, as there is danger of ruinously scalding the tobacco, now in its fresh, sappy state.

Two reliable thermometers should hang inside the barn, so that the temperature may be determined and regulated with promptness—the second one chiefly for use should one of them be broken. An ample supply of good dry wood should be provided before the curing begins. All conveniences and requirements should be at hand, as there must be no delays once the work is inaugurated. The tobacco must be hung on the day it is cut or gathered in all cases, and none of it must be allowed to scald in the hot sun after it is cut, which it may do in a few minutes if the sun is very hot. In leaf-gathering the leaves must be placed in suitable baskets as gathered, promptly delivered at the barn and stuck, and never be permitted to lie in piles until heat is generated. In curing bright tobacco everything must move rapidly but orderly, and if possible the barnful of tobacco should be hung and the fires started before the leaves become wilted.

When whole plants are cut for stalk-curing they should be taken directly to the barn either by hand or carefully drawn to the barn, hanging upon a suitable frame, by waggon. The practice of some growers of letting them wilt a short time in the sun is of doubtful expediency, involving the dangers of neglect and sun-burning. Every plant and leaf must be handled with great pains and care, as bruises, however slight, show badly in the cured leaf. Where doubt exists as to the proper degree of heat to be applied in curing tobacco, the safer plan always is to go slow rather than too fast.

The tobacco-barn should always, if possible, be at the field where the tobacco is grown, and the packing-house in close proximity to the barn. The saving of time and labour by this arrangement is very great.

Curing Mahogany Colours.

A slightly heavier-bodied leaf than that required for fancy brights is suitable for the light and dark mahogany types of tobacco. These types always meet with ready sale at fair prices, as they are wanted for fine plug wrappers. The prices paid for fine uniform mahoganies often range close up to those of fancy brights, and not infrequently sell for even more money when they are scarce and urgently desired for their particular use.

To cure mahogany colours by the stalk-cure system the tobacco is first partially yellowed in open-air scaffolds, or over a slow heat in the flue-barn. When the leaves have put on a mottled appearance the heat is run up to about 100 deg. for three or four hours. It is then advanced to 130 deg., and kept at that until the leaf is cured. When this is done, the temperature is raised to 160 deg. or 170 deg., and kept there until stems and stalks are thoroughly dry. The product will be a mixture of mahoganies and cherry-red tobacco.

In the leaf-cure system the top or tip leaves, the last of the crop, are often cured into fine mahogany stock. After hanging, the barn is warmed to 90° with one fire and left undisturbed for two days. The heat is then again fixed at 90° for thirty-six hours, when it is raised slowly to 135° until the leaf is cured. The fires are now put out, the barn closed up tightly, and left for three or four days. During this period the sap in the uncured stem runs back into the leaf. The fires are then started again and the heat carried slowly to 135°, and so continued until the stems are thoroughly dried out, which finishes the curing. The tobacco is then ordered and closely bulked, covered with blankets, and allowed to ferment. If the work has been properly done the result is a fine lot of rich mahogany fillers and wrappers. Sweet plug fillers are cured by firing the barn to 90° every morning only for five or six days till the curing is completed.

Curing Cigar-leaf.

Artificial or fire heat is seldom applied in the curing of cigar-tobacco, and never, except during seasons of continued rain, when slow fires in small stoves are burned to dry out excessive dampness. The thing to be avoided is too rapid curing. The leaf is kept moderately moist during the whole process, and is never permitted to become dry enough to break or crumble in handling. The temperature in the cigar-tobacco barn is controlled by doors, windows, and ventilators opened and closed at will. To prevent a too dry atmosphere the barn is closed tightly in dry weather, the moisture evaporated from the tobacco serving to keep up a certain degree of humidity, which is necessary to its proper curing. Thorough ventilation is necessary.

The barn is kept dark, as light affects the colour of cigar-tobacco. A dark rich brown is the colour aimed at. The development of aroma in fine cigar tobacco depends upon the proper fermentation of the leaf in bulk. This fermentation is rendered more certain and effective by the previous *gradual* curing of the leaf. In Cuba, Brazil, and certain parts of the United States the leaves only are cured. In dry climates the curing of a barn of cigar-tobacco is generally accomplished in six or eight weeks. In countries of a high degree of humidity, or in seasons of continued dampness, it takes longer time—frequently two or three months. Experiments are being tried in many places in curing cigar-tobacco by artificial heat, with promising results. More rapid curing by this means produces lighter-coloured tobacco—fashionable at this time as wrappers,—and is the means of preventing the diseases common in cigar-tobacco curing—pole burn and white veins. Tropical and sub-tropical climates produce the finest aromatic cigar-tobacco, and it is believed by many that contiguity to the sea is most favourable to its culture. The fine tobacco soils of Cuba are very similar to the bright tobacco soils of the Carolinas, heretofore described, but in these States the production of cigar-tobacco is confined to the sea-coast sections. Fine cigar tobaccos are grown in the Connecticut Valley, in the States of Connecticut, Massachusetts, Pennsylvania, and other regions far removed from the sea. The finest cigar-tobaccos, however, are those grown in Cuba, Sumatra, and other large sea islands, and in Florida.

The humid atmosphere of these countries is most likely the contributing cause of the superiority of their cigar leaf, and not the saline properties of the sea air, as some people are disposed to believe.

Considering the foregoing facts, there are good reasons for indulging the belief that much of the coast country of New South Wales and other parts of Australia can be made to produce excellent cigar-tobacco. Well-conducted experiments are necessary to determine the matter.

Bulking and fermenting.

When tobacco has been cured, stripped, graded into several lots—generally four or five in number, in stalk-curing, according to colour, size, and condition of leaf—and tied into hands of from eight to twelve leaves each, it is ready to be "bulked down" and carried through the finishing process of fermentation. The hands should be neatly tied with a leaf, covering the butts well, and tucking in the tie through the bundle below the well-wrapped head.

It must be borne in mind that leaf tobacco must not be handled or disturbed, except when in proper "case" or order. The leaves must be supple and pliable, so that they will not break or crack when grasped by the hand. When bulked, tobacco must be neither too dry nor too moist. If too dry, it will not ferment sufficiently to develop flavour and aroma, and become permanently dormant; and if too moist, a violent heat will be generated in the mass within a few hours which will render it utterly worthless in a short time if not checked by opening up, drying out to some extent, and rebulking. Good judgment, and that only, can determine the proper condition.

The bulks are generally made oblong in shape, and 6 or 8 or more feet long, made up of double rows of hands, lapping the leaves one-third their length in the middle, with the butts outward. They may be made 3 to feet high, rounded at the ends, and packed firmly with the knees or shoel

feet, keeping the exterior of the bulk nicely even and all leaves straight. If there is a depression in the centre a number of hands may be laid crosswise to fill in and round up the top. The bulks should be slightly weighted with boards, and well covered all over with blankets or tarpaulins to protect them from atmospheric influences. They should be carefully examined daily, or oftener, during the first ten days by inserting the hand into the middle of the mass. Good judgment is required to decide whether the fermentation is too violent. The tobacco should not get hot, but only moderately or comfortably warm to the hand. The good sense of the grower will be his guide in controlling the fermentation.

It is this fermentation—a process of nature—that brings out the good qualities of the leaf, and it is the neglect of it that ruins much valuable tobacco.

If all goes well with it the bulks will not be disturbed until fermentation has completely subsided, when the tobacco may be "prized" and marketed. If it is intended for export it is very important that the fermentation and conditioning shall have been well conducted and thorough, as the hold of a ship affords by no means a favourable environment for tobacco that has not passed through this process.

Local manufacturers using the locally-grown leaf generally prefer to buy tobacco before it has been fermented by the unskilled farmer. With ample warehouse and conditioning facilities, the fermentation is better regulated in skilful hands. Large buyers and shippers of tobacco likewise carefully grade, order, and ferment the leaf before prizing, in their own packing houses.

The warehouse system of the Southern United States is by far the most satisfactory method of "moving" the tobacco crop. It is a perfect system, regulated by law, and works with the least possible friction between seller and buyer.

It will be well for Australian growers and dealers to look well into it and adopt it as the industry is built up in this country, before some other system has become too deeply rooted to be changed. There should be a well-established "tobacco market" place in all marts where much leaf is sold and handled.

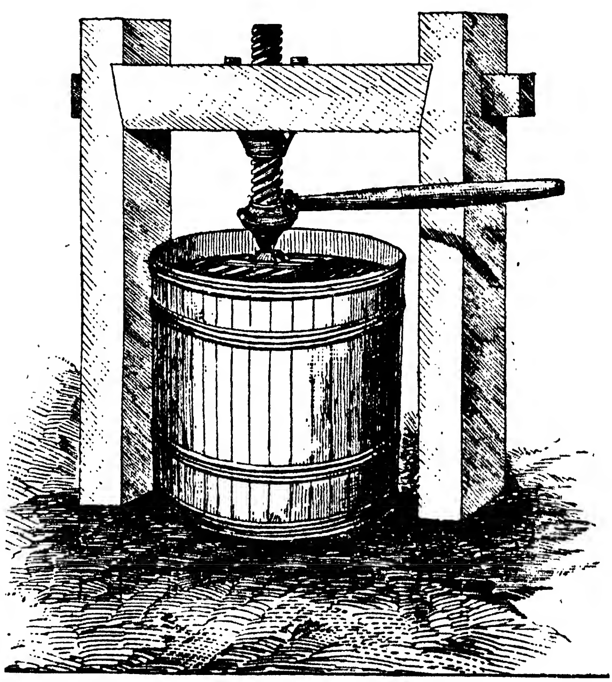
If sold in the local market, packing in boxes or hogsheads is not necessary. The local buyer or manufacturer should take it directly from the waggon in a loose though carefully bundled state, or at least in any convenient open temporary packages.

Pressing or Prizing Tobacco.

For shipping, tobacco may be packed in hogsheads or boxes. Hogsheads are made without bulge, of any strong, light timber, and strongly hooped. One end should be made 3 inches larger than the other, so that when the head of the large end is taken out, and the package inverted, the hogshead may be lifted off the tobacco, which will stand on the floor a solid, smooth block. This is necessary for inspection by the buyers. The usual size of the hogshead is 40 inches across the head and 52 inches in length, holding 400 lb. of leaf closely packed and well pressed. Boxes instead of hogsheads are often used for shipping tobacco. They are made of good 1-inch boards dressed on one (the inner) side and strongly cleated at the end corners. The customary size is 42 inches long and 30 inches wide on the outside, and 28 inches deep. Such boxes well packed and pressed carry 300 lb. of tobacco.

In packing tobacco the work should be neatly and evenly done, butts outward, without doubling or bending the leaves or leaving the semblance of a hollow space in the package. The hands should be taken from the bulk without shaking or opening up. If any are moulded they should be laid aside. A small quantity of unsound tobacco gives character to the whole lot, in the estimation of buyers, and brings down the price. It is profitable to have all of the tobacco in good condition, and neatness in the appearance of the package indicates careful handling and helps its selling value.

For pressing tobacco into hogsheads or boxes an expensive machine is not necessary. A log, 8 inches in diameter and 20 feet long, socketed into a tree affords sufficient lever power for ordinary "prizing," which is the primitive American term still in use. A follower or false head made of strong boards is placed on the tobacco, and upon this blocks are placed, see figure. The



pressure of the lever by the weight of several men is applied two or three times as the package is filled, the final filling leaving just room enough for the insertion of the permanent head, or nailing on the cover where boxes are used.

A common screw-press made of iron or steel is an all-sufficient press where a more convenient one than the log lever is preferred. It is easily and efficiently worked by hand, or horse power may be applied if desired.

It is not advisable to pack fine wrapper tobaccos with very great pressure for fear of injury by breaking or injuriously crimping the leaves.

Concluding Notes.

Reference has heretofore been made to the question of proper foods for the tobacco plant. It should be further emphasised, however, that tobacco is distinctively a potash crop. This element, in proper form (the sulphate), in liberal supply, is known to greatly improve the burning qualities of the leaf, promoting free and easy combustion and the constant accompaniment of a satisfactory smoke—a white ash. In the form of kainit and muriate of potash, however, this desirable ingredient is companioned with a large percentage of chlorine, which has been proved to greatly decrease the burning and fire-holding capacities of tobacco. These fertilisers should, therefore, be avoided. Nitrogenous manures, too liberally used, have the same effect, though in less degree, by increasing the albumenoids in the leaf which deter free burning. From these facts it is clear that only the proper mineral elements named, and no nitrogen or ammonia, are desirable for tobacco in soils already reasonably fertile.

In the foregoing treatise on tobacco—a subject that should deeply concern the people of New South Wales—many details are left untouched. Many suggestions proper to be made will readily occur, however, to those engaged in the culture of this most interesting and usually profitable crop. The subject is too expansive to be treated of elaborately in anything short of a considerable volume. A careful study of what is here presented will, it is hoped, lead the inexperienced toward the successful pursuit of the business of producing tobacco of fine quality.

Summer-pruning of the Vine.

M. BLUNNO,
Viticultural Expert.

Suckering and Disbudding.

By suckers are meant all those shoots which grow from the old stem and on any of its ramifications which are at least 2 years old. Generally, they do not bear fruit; occasionally they do.

But there are exceptions in which suckers, rather than to be suppressed, ought to be assisted and encouraged to grow.

To lower a stem which has grown too high, a sucker, lowly placed, is left and looked after, and on the next winter-pruning it is cut back to two or three eyes, while the upper, old, and worn-out stem is sawn off; so the vine is not only reduced to a normal height, but also, to a certain extent, renewed.

In old vines growing on poor and very dry soils, suckers must be accurately rubbed off. This operation may be carried by gently rubbing the stem with the hand if the suckers are just starting and their length being not yet an inch or so; but then, after a fortnight, the stem will again show some new ones, and this is mostly the case on some given varieties like the Aucarot, so the operation is to be repeated. If the suckers have been allowed to grow 4 or 5 inches, more attention should be paid to the *modus operandi*. As a rule, vignerons pluck off roughly these suckers; hence a lacerated wound, which denudes one of the strata of the bark—*cambium*. A stream of sap then flows to that wound; a callus is soon formed, from which, in very short time, more suckers shoot out; and the vigneron then has to contend with three or four of these sap-robbers, which may spring from the place of that one which was badly removed.

The best way to avoid this inconvenience is to cut off the sucker with the thumb and forefinger nails, leaving 1 inch of it on the stem. The little stump soon dries up, so any laceration of the bark is avoided.

Disbudding* is the removal of the shoots, growing on one-year wood, which do not show any fruit. Such shoots are worthless, and, unless required for keeping the vine in proper shape, should be nipped off.

Pinching and Topping.

The reason of the topping for the generality of the vine-grower is to conserve the sap for the better development of the canes, and the grapes hanging on them. This, like many other sound principles, is abused and misused in the practice; hence a failure, which is then accredited to the theory itself instead of to the method of performing the operation.

When we attempt to review all that has been published on the subject of certain practices of summer-pruning, such as the topping, pinching, or suppressing some of the leaves, and when we think that what is written is

* Müntz says the quantity of aliment absorbed by the vines from the soil is not in proportion to the crop they yield, because part of the nourishment goes to feed the natural excess of wood and foliage-growth. By suppressing any of the bunchless shoots as soon as their infertility is evident the ground will not be compelled to afford aliment to parts that give nothing in return.—M.B.

not grounded on simple theory, but on the observance of the traditional systems of many vine-growing countries, or on regular experiments lasting for eight or ten years, and carried out by clever experts, we are struck by the difference of the results, and find that it is not very easy to plan out a rule to give the vignerons as their future guide on the matter.

Columella and Palladius, two ancient Latin agriculturists, are in favour of the topping; Guyot and Vergnette-Larnotte are also partisans of the same, but only for some of the French districts, as the Marne and Bourgogne. Most of the authorities of the Gironde are also in favour of the same practice, so is Cazeau-Cazalet; Von Babo, who wrote for the German districts, says that the topping and disbudding are the more necessary the more northerly are the vineyards; Casoria and Savastano point out the difference existing in Italy between the vineyards even of the same district. In the province of Palerme, about the Vesuvian region, in Tuscany and in Piedmont, they top and disbud or not according to the kind of soil and the system of pruning, though the experiments undertaken by the two last authors and those of Dr. Pellegrini would cast out the practice as a useless one. However, the late Professor Macagno and the Drs. Cuboni, Cerletti, Soldani, Caruso, Ferrari—all Italian authorities—are *mutatis mutandis* of opinion that the topping has a beneficial effect as to a higher percentage of sugar and a lower one in the total acidity of the grape-juice and as to getting more berries and larger ones.

From the foregoing it appears that nearly all are for the topping and other operations of summer-pruning, but many of them differ about the details and the conditions to be observed to secure the success. Through the analysis of their observations, however, I gather that the climate of a given district, the variety there grown, the extent to which the topping and kindred operations of summer-pruning are carried out, and, not least, the time of the season when it is effected, are the capital points.

So far the last studies on the subject are by Messrs. Viala and Rabault, who experimented during the last ten years and treated it from many sides.

There are some varieties of grapes—like the Gamay and Petit Bouschet, for instance—that are not benefited at all by the topping in any of the French vine districts. The Syrah (syn. of Black Shiraz and Hermitage) and the Cabernet Sauvignon (syn. of Carbinet Sauvignon) gave more sugar and less acidity when they were topped. The Pinot noir (Black Burgundy) showed less sugar and more acids in Bourgogne when topped, and more sugar and less acids in the region of the Hérault. In the last instance, however, the variety was grafted on American stock, proof to Phylloxera, and its vegetation was by far more vigorous. It appears that the topping is successful most particularly on varieties of stronger growth; in fact, Syrah and Cabernet are much stronger than the Gamay and Petit Bouschet, on which the topping, rather than being of any advantage so far as a larger percentage of saccharine matter is concerned, is detrimental.

The above principle is corroborated by two new instances. The Espar and the Cinsaut when grafted on the Rupestris, with which they graft very well, so having a vigorous vegetation, gave after the topping more sugar and less acidity while when worked on Riparia, with which they do not graft so well, and the vegetation therefore is weaker, the topping had just an opposite effect.

The Aramon, the Alicante, the Alicante-Bouschet, the Herbemont, the Folle Blanche (this last being the grape that is generally used in the Charente for the brandy-making) must not be topped.

The system of pruning has no influence upon the success or not of the topping. Some of the above-mentioned varieties were trained on three

different systems—viz., the goosebery bush, the Cazenave, and Guyot's method (*), the effect of the topping being simply and only depending upon the nature of the variety of grape and not on the system of training.

But if the topping is too drastic, even those varieties which are favourably influenced by the topping will give a quite contrary result. The Cabernet, the Syrah, the Malbeck gave the best returns when topped, allowing four or five leaves above the last bunch of grapes. Those which were allowed only two or three leaves on the upper cluster gave grapes poorer in sugar and richer in total acidity.

Nor had the pinching or topping made before the blossoming any effect on these kinds of vines, but they showed remarkably good results only when topping was carried on soon after the blossoming was over and flowers had set. The topping at a later period does not do any good, but is even disadvantageous.

One thing I must not omit. The abstraction of the top of the shoots on some varieties does not only result in a larger percentage of sugar and correspondent diminution of acids of the must, but, as a rule, causes the berries to grow larger and more juicy even so far as those vines which do not receive any benefit in augmenting the quantity of saccharine matter are concerned. This fact was plainly proved by the Malbeck, which often has small berries mixed with those of normal size. In some cases it gave one-twentieth more crop out of the plot submitted to the topping than in that not so treated.

Now resuming about some of the experimented varieties which are also grown in our Colony, we may say that in France, at least, the Syrah and Cabernet benefit by the topping, not only increasing in the percentage of sugar, but also giving larger and more juicy berries. The Malbeck does not show any larger amount of saccharine matter, but it gives a somewhat heavier crop. The Pinot noir (Black Burgundy) behaves like the Syrah and Cabernet when grown in conditions of soil and climate favourable to a vigorous growth.

Though the locality seems to have no influence on the mentioned results, which, I reiterate, mainly depend upon the character of the variety, on the time and manner the topping is carried out, it would be most interesting to undertake experiments in our colonial vineyards, and with all the mostly-grown varieties; but first of all I wish the vigneron to learn how and when to pinch or top the shoots, because I have seen this work often done in the most unaccountable way.

I know one vine-grower in this Colony who tops actually above the upper bunch, allowing only one leaf; and he, on being asked of the reason of that radical nipping off, answered he did so to force the sap back into the grapes. How the sap can go back when it has not had the time to go on I fail to understand, because he tops the shoots so drastically as to leave only 7 or 8 inches, often, as I said in the foregoing, allowing only one leaf on the upper bunch of grapes. The laterals, he said, which will spring off after such topping, would feed the grapes; but I do not see why one should rely upon the laterals, which at all events will never feed the grapes as well as the normal shoots.

These axillar shoots often grow spontaneously, even if no topping has been adopted, and this happens when the vine is too vigorous, and the number of spurs or the length of the canes are rather small in proportion to the strength of the stock. Even in such cases they are considered useless to the ripening of the grapes, and so they are nipped off, leaving one or two leaves for feeding the eye situated immediately beneath.

* Vide *Agricultural Gazette*, June, 1897.

It is only when vines have been badly tried by any insect or fungoid pest which may have destroyed many leaves that these laterals can be considered a great help to further the ripening which was checked. When the vine is healthy, with a regular number of strong shoots, I do not see why these should be summarily curtailed, with the idea of getting the laterals to do a work which naturally they are not adapted for.

I know of a vineyard planted three years ago where the vigneron did also the pernicious work of curtailing without any discrimination, with the idea of strengthening the young stocks. Then, on the third year, he decided to make trellises of his vines. I went there, and I could, nine times in ten, hardly find canes of a proper length to stretch along the wire, because they were all very short, and there was a disproportionate number of axillar shoots, which, as is well known, can hardly be relied upon as wood-bearers of good fertile shoots.

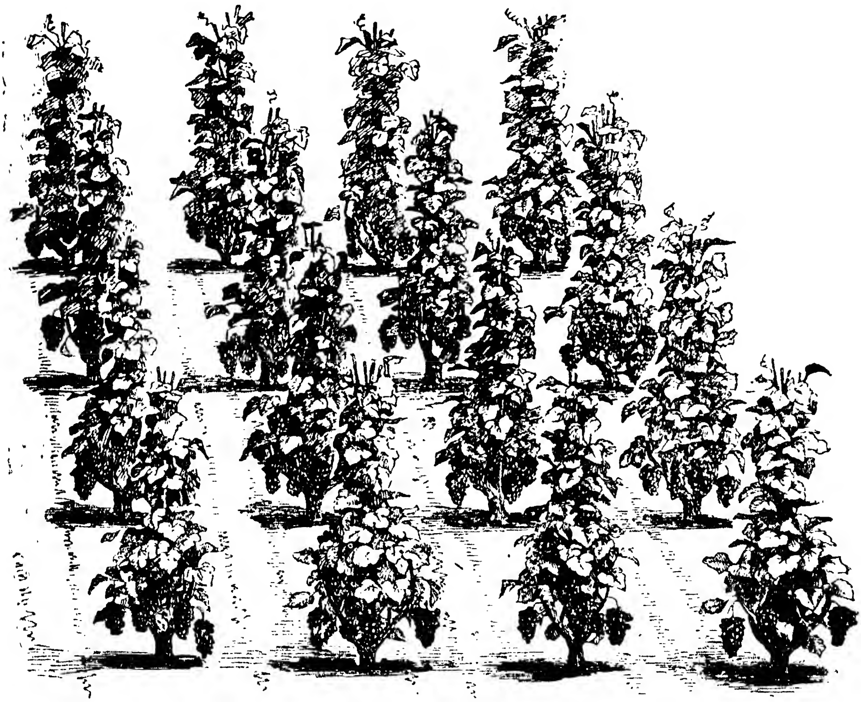


Fig. 1.

Every vine in healthy condition has more leaves than are really wanted. This, perhaps, may justify in some way the practice used in some vine-growing districts of suppressing some of the leaves in order to expose the grapes to the beneficial effects of the sun, but I must not omit that, while this is perfectly right in cold climates, where the sunny days are not many, the system cannot be recommended in hot, sunny places. Here grapes need to be sheltered to avoid any scorching effect of the solar heat, which, when too severe, has a different result, *i.e.*, instead of promoting the function of assimilation inside of the leaves, checks it. In fact, many vignerons must have noticed that in very dry and hot seasons grapes do not ripen well.

They look as if they were mature, as far as the colour of the berries is concerned; but then the must is not so sweet, and is rather too acid, and the proportion of juice not so plentiful as in the years of normal summer temperature. Many must have also seen the beneficial effects of a good downpour during a period of very intense heat on the ripening of the grapes. The moisture in the soil in the surrounding air and the lower temperature makes the leaves and the grapes start their physiological work again, which work was nearly suspended.

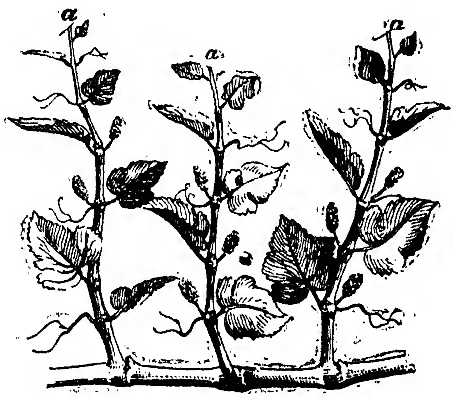


Fig. 2

The top leaves of a vine-shoot—say, those small leaves of the extremity which have not a normal size, and are not of a deep-green colour—do not do any effective work, because in them the chlorophyll is not well formed and scarce, so they are unable to do any work of assimilation to prepare the starch, which is the startpoint of the sugar. Hence one may suggest the expediency of doing away with them. I fall in with this idea, therefore the topping should only be limited to the removal of three or four inches, as it is shown in fig. 1.

Many experts prefer the pinching, which then is done earlier—say, soon after the flowers set. By only nipping off the terminal (see fig. 2 *a a a*), to which is entrusted any extension of the shoot, this is checked in its growth.

Fig. 3 represents vines trained on the Guyot system. The shoots bearing grapes (*o o o*) were pinched as they reached the height of the wire F, whilst

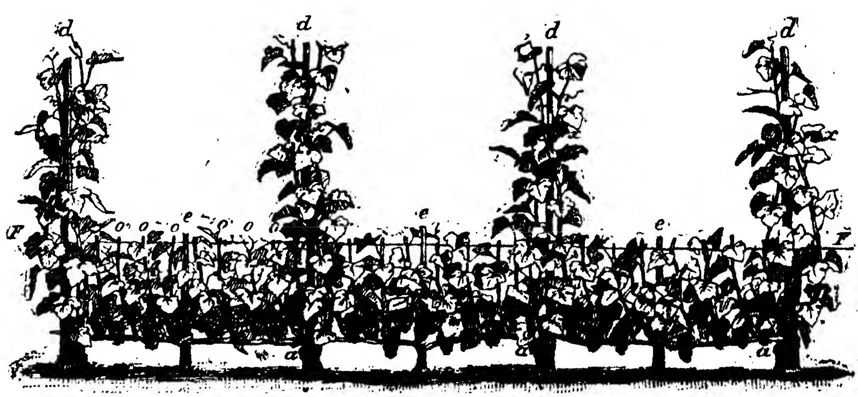


Fig. 3.

these long ones (*d d*) on each stock of the same drawing, which sprung from the spurs are meant to furnish the canes of replacement for the next winter pruning; consequently, they are allowed to grow unmolested in order to obtain a respectable length.

The Figs. 4 and 5 represent two vines trained on the gooseberry bush system, in which no topping was effected; but then the shoots, when they had reached a convenient length, were fastened and intertwined in the first instance, while in the second they were fastened, and the top twisted down.

Fig. 4.

Fig. 5.

This method of bending and twisting the young shoots controls their profuse growth in length, and also the flow of the sap, which will be better elaborated. Furthermore, the shoots and leaves of each vine being kept together, do not hinder the easy working of the ground, and, moreover, the grapes are well sheltered.

Abortive Flowers.

When the flowers of the vine do not set and transform themselves into fruit there is a case of abortion (*coulure*, *colatura*). This may be caused by three different reasons, which we will consider separately.

Those who are a little acquainted with vine-growing must have noticed that on some particular kinds of vines the fecundation does not take place, hence any amount of berries are missed, and on examining those tiny flowers one can see that the male and female organs are not well developed. This is a constitutional affection against which nothing can be done. Among experts these flowers are called *coulards*. Some varieties of muscat are conspicuous for this inconvenience, while most of the American true species, and many of their natural hybrids have but *coulards* or imperfect flowers.

Sometimes the abortion of the flowers, even if, physiologically speaking, well constituted, is due to the invasion of parasites at the time of the blossoming, against which the preventive specific remedy suggested for each infection should serve to prevent the damage. When, during the blossoming, the temperature of the air falls rapidly, or when the blossoming coincides with a period of foggy weather, many flowers are missed, and often what would have been a bunch of grapes will be a tendril. This, however, is not much to be feared in our climate.

But often the fecundation of many flowers does not take place regularly, hence a scarce fructification, through the superabundant vigour of the vine, and consequently of the shoots, because of a strong flow of the sap, which is mostly characteristic of vines in low and wet soil. Then the flowers are "drowned," to translate the term used by the vignerons of some vine-growing districts of the Continent.

In the case of too much moisture in the ground, a good drainage would assist in preventing the inconvenience. If the strength is due to the high fertility of the soil, then more spurs or canes should be left on the stock at the time of the winter pruning.

Annular Incision.

Finally, there is the annular incision, to which the vigneron can resort. I say, however, that this could hardly be adopted as a general practice by a vigneron who owns some 40 or 50 acres of wine-grapes vineyard, and it is mostly considered suitable to those who grow some vines of table varieties. The operation consists in taking a ring of the bark off the shoot which the clusters of bunch hang on, and do so about one inch below the lower cluster (*see* Fig. 6) a fortnight before the time of blossoming. In this case the annular incision affects the one particular bunch which was operated upon.

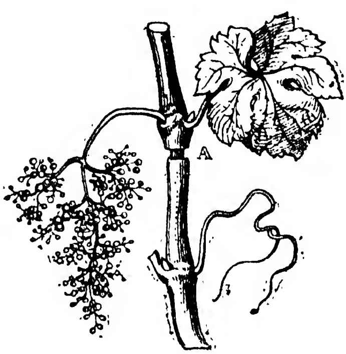


Fig. 6.

It may be performed instead at the time of winter pruning on the one-year canes or spurs.

Then the ring of bark is taken off a couple of inches from the insertion of the cane or spur on the stem. This annular incision so affects all the shoots which will spring from that branch.

The width of the ring of bark to be detached is not more than four lines, and attention should be paid so as to not hurt the wood underneath. The point of a sharp pen-knife may be used for this operation, though there are the so-called *pince sève*, which are now available for this purpose. A *pince sève* is a sort of scissors, each piece of the scissors having a double blade.

The wound heals during the same season, an accumulation of material just above the incision causing a sort of swelling, because the sap is kept back through this discontinuity. To explain this I must not omit that the sap, on the beginning of the vegetation, flows throughout the central part towards the top of the canes and shoots. Then it is in a sort of raw state, and during its ascension it becomes richer and more refined as it starts to descend (elaborated sap).

The operated part is weaker; hence, in accordance with one of the principles that I put as startpoints in my former paper, "Pruning the Vine,"* the plant is better disposed to fructification.

The grapes of incised vines are not only more plentiful, but the berries are also bigger, while the ripening is ten days or a fortnight earlier. I must say, however, that the shoots operated are brittler, and they should be bound to the vine stake in order that strong winds may not break them down. They also are difficult to handle at the time of the winter pruning, because of their brittleness.

The annular incision exhausts the vine a little, consequently cannot be repeated every year.

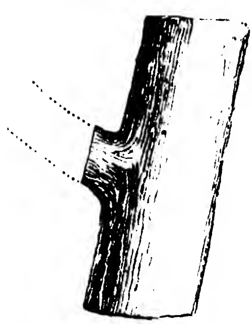
* *Vide Agricultural Gazette*, June, 1897.

Pruning Ornamental Trees.

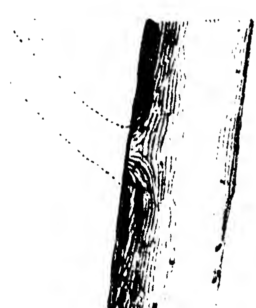
H. V. JACKSON.

Of all operations connected with the growth of a tree, pruning is one of the most important, being a process whereby stems, branches, or roots are removed, repressing or checking superabundant growth. Pruning is not done for the sake of pruning, but is done with a view to bring about practical and beneficial results, a most important principle being not to remove any limbs or branches from forest trees unless for some cogent reason it is deemed absolutely desirable and necessary. Therefore, before a person prunes a tree he should be perfectly certain that he knows for what purpose the operation is intended, otherwise something disastrous will result.

It is sometimes necessary when transplanting young trees to cut them back somewhat; and at a later period it may be necessary to judiciously trim off such laterals or side shoots as threaten to grow more robust than the natural "leader." Dying or dead branches it is also necessary to remove quickly, before their decay extends to the wood of the main trunk.



Badly cut.

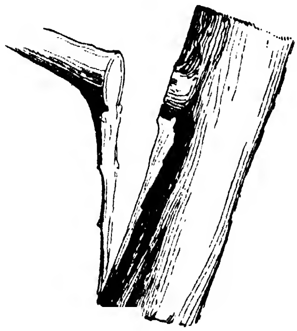


Properly cut.

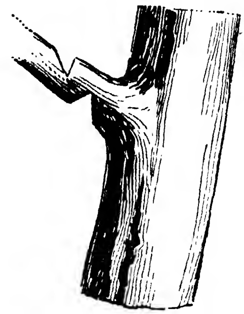
When removing a branch it should be cut off close to the tree in such a manner as to leave no projection, and the cut should be left as smooth as possible.

Care must also be taken when cutting heavy branches to avoid the possibility of the limb, with its own weight, tearing away the bark or a portion of the wood.

A means of avoiding such a breakaway is to make an incision on the under-side first of all; then a cut may be made higher up the branch, and



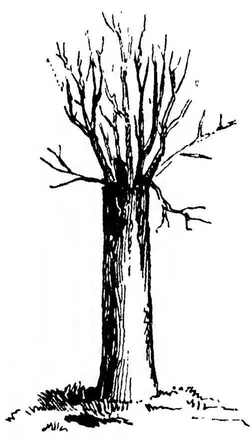
Sawn limb tearing away bark and wood.



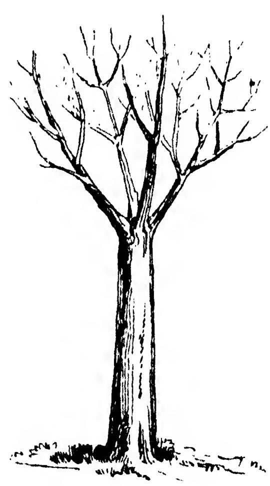
A mode of cutting off a large limb.

right through. When the limb has fallen, the remaining stump is sawn off close to the tree-trunk as smoothly as possible, and the naked wood is then painted to complete the operation.

Where it is desired to make the trees form an umbrageous head, by means of the system known as "Pollarding," as is sometimes done with willows



Unsightly pollard.



Proper method.

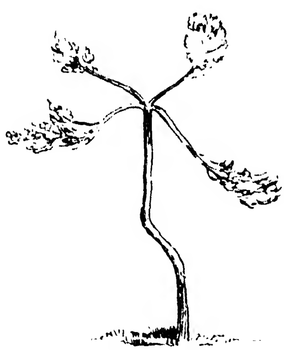
and poplars, the main trunk should not be cut back, but the main spurs are cut.

This promotes a more rapid formation of new growth, resulting in a more symmetrical head.

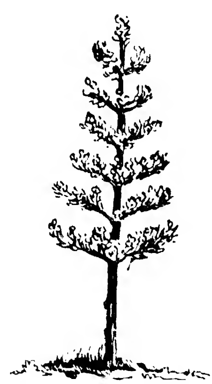
When removing small limbs or branches do not leave spurs—they become very unsightly, and in course of time, if decay should set in, they become a source of injury to the wood of the main trunk. The same thing applies to broken branches if they are left to decay and rot; and for that reason all dead portions should be carefully removed by cutting close to the trunk.

Sawn board, showing deteriorated breakaway resulting from a dead branch.

Deciduous and evergreen forest trees require most attention when planted for ornamental purposes along roads, or in parks, or other enclosed areas; but in ordinary forest plantations the trees should be planted so closely that pruning will hardly be necessary, all the attention required in a course of years being a judicious thinning out. This is especially the case with the pine species; but to establish the oak, elm, and other like deciduous trees, with good, clean, straight trunks, more attention is needed, as they are disposed to throw out heavy crops of laterals when planted widely apart.



Quercus robur neglected



Quercus robur properly cared for.

Any attention required should be given these trees whilst they are still young, as if neglected in the earlier stages there is always difficulty and loss in attempting to remedy ill-shapen growth later on.

The pruning of forest or large growing ornamental trees, which have been planted out for shade purposes, should be very judiciously performed. After being planted out, while the trees are young, any trimming or pruning should be done so gradually and temporarily that while the tendency is towards an upward and straight growth, a firm, sound, and strong main stem is produced.

In this connection it is necessary to watch for and remove any lower shoots or suckers, which, if left alone, would develop into the formation of

double or treble main stems. If more than one single leader has formed as in figure A, they should all be removed excepting that one which is best calculated to make the best and straightest trunk for the future tree, when the tree will appear as in figure B.

Fig. A.

Fig. B.

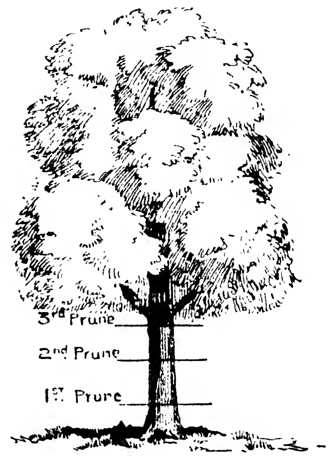
Coniferous trees should not be subjected to the "knife" unless actually necessary for some specially urgent purpose, and when large branches must of necessity be removed the wound should always be covered with a coat of thick paint or coal tar.

Where park or avenue trees have been allowed to grow with laterals branching from the main stem almost level with the ground, and it is desired to raise the line of lowest branches for public convenience or other purpose, it is generally desirable to arrive at the object in view by steady successive operations season after season rather than by cutting wholesale into the tree all at once, thereby giving the tree a rude constitutional shock, and possibly for a while rendering it unsightly to the public eye.

Another matter of great importance is that the too sudden removal of a large quantity of shade bearing lower laterals brings into full exposure the surface of the ground covering the roots; and should very dry sunny hot weather supervene there will inevitably follow a parching of the root fibres, altogether foreign to their constitution, formed, as they have been, in dense shade for years.

By the system of gradual pruning into shape the work is not noticed, the tree will not suffer to any appreciable extent, and as it is growing all the time, upon the third or fourth final pruning taking place the balance and symmetry of the tree will have been retained.

Pruning is practiced in summer and winter, mostly, however, during the latter period, and forest trees should generally be treated after the growth of the season has been formed. The best time for pruning off heavy limbs



is when three-parts of the summer season is past, right on into winter, but early enough to allow of the wounds healing before heavy frosts set in. Lighter branches may be trimmed at any time so long as frosts are not prevalent.

Profitable Poultry-breeding for the Local and English Markets.

GEO. BRADSHAW.

(Continued from p. 731.)

CHAPTER XIII.

Local Marketing.

In poultry, as with other agricultural produce, a question of the very first importance is marketing; and there is no doubt but that much of the former lack of interest in the poultry business has been due to the very low prices obtainable in our local markets. This was more evident during the past two or three years, when the very low prices for cereals influenced many farmers to much increase their poultry flocks, thinking that feeding their wheat to fowls would make them a better return than 2s. 6d. a bushel, the then ruling market price. However, the lax methods employed in the poultry rearing were not responsible for all the disappointments of the business, the loose manner of marketing further contributing to that end.

When in an earlier part of this work I wrote disparagingly of the table poultry sent to the Sydney markets, I did not wish it to be inferred that the entire supply bore the character of poor scraggy specimens. That there are good poultry reared in the Colony cannot be denied, but too frequently these are put on the markets with handicaps which detract from their fetching full market value, and too often mean a loss to the producer where, with the exercise of ordinary care, the transaction would have been a profitable one. A very large part of the Sydney poultry supply comes by steamer from the Northern districts, being forwarded to the Sussex-street agents for disposal; and shortly after the arrival of the steamer are taken delivery of, and placed outside the respective stores for sale. Anyone interested in the marketing of stock can any day see numerous examples of the loose methods adopted by the producers in placing their goods before purchasers.

Number 1 coop or crate may contain a dozen really good chickens, which, had they been alone, would possibly fetch 4s. a couple, but included in the crate are half a dozen much younger ones, too small and too poor to find buyers. A poulterer comes along, and to get the good chickens which he requires is obliged to take the poor ones as well, the entire lot much lessened in value. The agent cannot be expected to separate the fat from the lean, the old from the young, or the healthy from the sick, and did he, the undesirable lots would too frequently be left days on his hands before finding a purchaser—did they live to such a time—and then only at some nominal figure.

Number 2 crate may have a score of excellent table fowls, the handicap in this case being the fact that half a dozen old hens accompany them, their presence approximately reducing the price from 4s. to 3s. per couple.

Another lot may consist of a few good marketable fowls accompanied by a patriarchal rooster, whose presence injures the sale of his younger companions. Other crates have been observed where two or three very small or sickly chickens have been included with an otherwise good lot, the weak ones in this case arriving trampled by the strong and healthy.

Other cases have been noticed of ducks and fowls mixed; of a crate of good ducklings affected for ill by the presence of perhaps the parent drake, or a couple of old Muscovies; while, in what is called the duck season, the deaths in transit to Sydney due to unsuitable packages, overcrowding, or other causes, frequently amount to 10 per cent. of the whole.

The illustrations I have given and others may be noticed any day, and those who have gone into the matter calculate that fully 20 per cent. is lost to the consignee through this inattention or neglect.

That this great loss is preventible is easily understood, and the wonder is that such an expensive apathy is allowed so long to continue.

The producer who has a mixed lot of chickens to market should assort them and send in two crates, the best in one crate, and the inferior lot in the other.

If he has a lot of good-sized fat chickens, and three or four smaller ones, rather than imagine that he can get the few inferior ones sold with and at the same price as the prime, they should be kept at home. When buyers are purchasing they do not look in the crate for the best specimens, but the worst, and purchase accordingly.

Where the desire is to "run in" an old rooster with a lot of good stuff, the little plan invariably fails, inasmuch as if disposed with the others he will detract from the value of the lot. It will pay the owner best to eat the old bird, and market the young ones. When young table fowls and old hens are to be disposed of, they should be sent in separate crates; the same with ducklings, only those of a like size should be consigned in one coop. Should a few of small size be amongst the large ones, they are invariably trampled to death on the journey; old ducks should be sent in separate crates from the young, and in all cases it will pay better to destroy sick birds, than to attempt to dispose of them amongst healthy ones. Overcrowding should also be avoided, frequent deaths occurring from this cause.

Marketing Eggs.

It is one of the strangest things imaginable that any suggestions concerning the simple subject of "selling eggs" should be necessary, yet such is the case. The unquestioned fact being that were the supply of eggs graded according to size and colour, and forwarded perfectly clean, it would increase their value by ½d. a dozen in summer, and at the least 1d. in the winter months. This appears but a small item; still from the daily papers we see that 8,000 dozen of eggs left the Clarence District in the month of August; hence a sum of over £30 was lost to the producers for that month through neglect in this particular alone. When consignments are small, grading whether to size or colour is scarcely practicable; but it is frequently the case when storekeepers are the consignors. The quantities are large, and it would pay well to first wash all the soiled eggs, then "candle" them to prevent any bad ones reaching the market, and thus injure his brand. This "candling" in expert hands can be done very expeditiously, and by having two receptacles eggs can be graded into whites and browns, at the same time, which will insure them a more ready sale, and at a better price.

In an earlier chapter, I made special reference to the great disparity between the price of eggs in the summer and winter seasons, and attributed

the cause to shortsightedness in not arranging the hatching season, so to have the pullets coming on to lay in the dear months. Should this be systematically done by the large body of poultry-keepers, the increased production in the scarce season would certainly bring the price a little lower. This, however, would be far more than met by the higher price in the spring and summer, resulting from a decreased supply at those times. Indeed were the egg supply regulated as suggested, there is no reason why the minimum price should be less than 8d. a dozen at any time of the year; however, there are no grounds to believe that such favourable anticipations may soon be realised; hence it is left me to suggest some means whereby the producers may receive more than the 4½d. or 5d. per dozen, the usual return for some months in the year. This can be accomplished by either of two ways, or both. The first is, that in place of forcing the eggs into the market in the cheapest time, some satisfactory system of preserving be adopted with a view of selling them when prices are much higher; the other plan is exporting them to England, for like other classes of colonial produce, our plentiest and cheapest time is the scarcest and dearest in England, and both ways can be relied on to give excellent results. I shall now briefly describe the most simple and up-to-date methods of preserving, and will leave the exporting for later reference.

Preserving Eggs.

The natural propensity of the feathered tribe is to lay their eggs and hatch their young in the spring; and although fowls, through domestication, produce eggs all the year round, still, in spite of this domestication, nature asserts itself, the spring months being those wherein all fowls produce their eggs in greater abundance, the effect of this increase in the supply being responsible for the very low prices obtainable at that season of the year. To keep or preserve this surplus supply until the months when they are less plentiful and more profitable has occupied the minds of householders and poultry-breeders from very early dates, and still does, new methods appearing with unvarying regularity.

The four principal methods of preserving eggs have been given as follows:—The wet method; the dry method; the heating method; and the cool method,—the main principle being to keep the eggs from contact with the air. On 8th February, 1791, William Jaynes was granted Letters Patent for preserving eggs. The formula is in extensive use at the present time, and is called "Jaynes' Pickle." Since that time over eighty patents have been granted in the United Kingdom for preserving eggs; but it has been proved that very many of them have been interesting experiments rather than commercial methods.

Five pounds of fresh slacked lime, one pound of salt, and half a pound of cream of tartar, dissolved in about 20 gallons of water, will be found the cheapest and most effective of the wet methods; a water-tight vessel is then to be almost filled with eggs, and the pickle poured on until the eggs are thoroughly immersed. The vessel should then be hermetically covered, placed in a cool room or cellar, and allowed to stand unmolested for three or four months, when the market price will be 1s. to 1s. 6d. per dozen; consequently, for the producer or egg-merchant, the investment will make a return of over 100 per cent.

Egg-pickling is carried on to a much greater extent in Victoria than in this Colony; so much so that in the dear months the daily papers there give quotations for pickled as well as new-laid, threepence per dozen usually separating these from new-laid. They are sold openly in the Melbourne

markets as pickled, and purchased as such. The pickling is usually done by dealers who purchase in the cheap months, and market in the dearest, and as 1s. 3d. to 1s. 6d. per dozen is a frequent quotation for such, the profit is apparent. Of late, many of the Victorian farmers are preserving or pickling their own eggs, thus getting the full profit for their produce—as they should.

Pickling, or otherwise preserving, is done in a moderate way in this Colony, chiefly by confectioners, they being alive to its advantages, and thus reaping the 200 or 300 per cent. profit which should legitimately belong to the producers. Dipping the eggs in melted fat, butter, oil, or liquid paraffin, is also recommended. Water, with 5 to 7 per cent. of salt, will also preserve for at least three months. Of the wet methods, "Jaynes' Pickle" has stood the test so long, it possibly cannot be improved on. However, in this warm climate, its advocates usually make it stronger than the original formula.

The dry methods are more simple still, and consist in tightly packing the eggs in either dry bran, pollard, sand, lime, or other substance. The following is, perhaps, the simplest and most satisfactory of the dry methods, as the writer can testify, from one of his own exhibits, which was awarded a prize at Dublin Dairy Show some thirteen or fourteen years ago. The class was for preserved eggs, to be delivered to the Secretary four months before the opening of the Show, and to be tested in both the raw and cooked state. There was a large number of exhibits, and all manner of packing and preserving used. Those of which I speak were simply packed in dry salt, and they opened out as fresh as the day they were laid. The dry salt system has also been tried in Australia, and to my own knowledge, eggs embedded in salt for nine months were quite good. The system is the more satisfactory from the fact that the eggs come out quite clean, and have no appearance of having undergone any process, while the same packing (salt) can be used for years; hence it is not coupled with any great outlay. Large boxes or barrels will suit; 2 inches of salt to be placed in the bottom, then a layer of eggs; the salt to completely cover these, and a repetition, till the case be filled to within 2 inches of the top; it should then be filled with salt, and the lid nailed down.

The hot method is a simple one, but I cannot vouch for its efficacy. Water is heated to about 150 degrees F., and a basket of eggs is dipped in, and left there for thirty or forty seconds, which coagulates what is called the pellicle under the shell, thus excluding the air.

The cool methods are the most effective of all,—the simplest being to collect the eggs fresh, pack in any box or basket, and place in a cool cellar at any temperature below 50 degrees. In this way they can be kept fresh for three months at a time—sufficient to test the profitableness of the experiment. In or about many farm houses there are such places, and, if not, a pit dug in the earth can be utilised.

However practicable any or all of the above systems may be, the freezing chamber or cool method is for all purposes the best. The only thing to do is to pack the eggs in boxes or other receptacles, and keep in the cool chambers, at a temperature slightly above freezing point—say, 32 to 36 degrees—and there is no further trouble. With this temperature the eggs can not only be kept an interminable time, but can be sold, and have been, in thousands of dozens, as new-laid, and fetched in England top market price. Nor is there any deception in describing them as such, for in a temperature as noted everything in the egg is held in suspense. There is no process of decay, consequently they retain all their original qualities, which cannot be

said of those treated by many other processes. The one great handicap to this plan is, that it cannot be generally adopted, from the fact that there are at present no cold-storage chambers with a proper and continuously regulated temperature; and were there such, and a moderate charge made, I feel sure they would be well patronised; nor need there be any doubts as to the nature of the results. Possibly the most important and interesting circumstance in connection with the cold storage of eggs is the fact of a complete suspension of the manifestations of life, and the reversal of this when placed under a hen after many months in the cold stores. Should the temperature fall below 32 degrees, and the eggs freeze, all vitality will then be destroyed; but if over 32 degrees, and under 40 degrees, eggs five months old have been known to hatch; and how long this vitality can be held in such suspense has not yet been determined.

Preserving eggs has of late been receiving much attention in some of the daily papers, stress being laid on the statement that infertile eggs are the best to preserve. This is certainly correct; but as the majority of breeders keep male birds with their flocks, the recommendations are of little effect.

So far as "Jaynes' pickle," the "dry salt," and the "cool chamber" methods are concerned, eggs to be fresh is the only essential. I should also say that there are chemical compounds of various kinds patented for preserving eggs, which are effective enough in preventing decay; but consumers have an aversion to any foods known to be treated with preservatives. Before leaving this subject I should observe that the possibilities of the egg trade, through the instrumentality of cold storage, are very great; and I look forward to the time when huge quantities will be stored in this way during the cheap season, and kept until the scarce time, which would do much to restore an equilibrium in the summer and winter prices, and still further assist in making poultry-breeding as valuable an adjunct to the farm as it should be.

CHAPTER XIV.

Export Marketing.

INDEPENDENT of the recommendations of this work becoming adopted, there is not a doubt but poultry-breeding for profit, *i.e.*, marketable fowls and eggs, is about to become more general than has ever been in the Colony; and as the local consumption is of a very limited kind, and cannot be much increased, the inevitable result will assuredly be much decreased market values.

In seasons of low prices for cereals, poultry can be reared profitably, at figures even lower than those now ruling; but, speaking generally, should poultry become much more plentiful the Sydney prices will become unprofitable, and we will have to look about for markets beyond Australia, has had to be done in connection with our meat, butter, and other produce; and the same process—the refrigerating chambers—which has for a number of years landed the above perishable products in the world's market, has already come to the poultry-breeders' rescue. Many thousands of fowls, ducks, geese, and turkeys from the other colonies during the past three years have been landed in London in excellent condition, many of which were sold at good payable prices; and, however essential the paying element is to the success of the export poultry trade, other and even more important results have followed.

It is very well known that, for a number of years prior to 1894, poultry of all descriptions in the Melbourne markets ruled at prices 20 to 25 per cent. lower than in Sydney, while in the early months of that year they

were frequently quoted in the daily Press as almost unsaleable. This fact prompted the then Victorian Government to send a few trial shipments to England, to test the practicability of an export poultry trade. These, after paying freight, London charges, and other expenses, brought net returns to the shippers much in excess of the then local price, with the result that the Agricultural Department of that colony established an export depôt, to advise, assist, supervise shipments, and in other ways to establish a trade with England in poultry; the first year's transactions showing that 35,000 head of various sorts were placed on the London markets. The effect of these large numbers leaving the Colony affected the local markets to such an extent that poultry breeders in Victoria have for the past two years been receiving prices in the local market unheard of for a long series of years, from 50 to a hundred per cent. more than the ruling price in Sydney for the same class of goods. The daily papers of the two colonies bear testimony to these statements, as the following quotations will show:—

January 7th, 1897, Melbourne.	January 7th, 1897, Sydney.
Fowls, 4s. to 5s. 9d. per pair.	Fowls. 2s. 6d. to 3s. 6d. per pair.
Ducklings, 3s. 6d. to 5s. 6d. per pair.	Ducklings, 2s. 6d. to 3s. 6d. per pair.
Geese, 3s. 6d. to 5s. 6d. per pair.	Geese, 3s. to 5s. per pair.
Turkey hens, 5s. to 6s. 6d. per pair.	Turkey hens, 4s. to 5s. per pair.
Gobblers, 10s. to 15s.	Gobblers, 7s. to 10s. per pair.

Every month since January the same or a greater difference has been witnessed in the prices, and in the present month (September) poultry of every description in Victoria has been at famine prices, fowls and ducklings going up to 7s., geese to 10s., and turkeys to 20s., per pair. That there were many consignments sent to England, which would have done as well or better in the local market is true, and a few lots on which losses were made, but this was a small price to pay for the enormous benefits which have resulted therefrom, and has been calculated at some thousands of pounds. The most remarkable thing in connection with Australian poultry in England is the fact that when our beef and mutton—no matter of what quality—is sold there, it fetches less than half the price of English, but when suitable poultry have been sent they have always sold as well as the home-grown.

The following account sales of actual shipments are at present before me, and are worth reproducing. A farmer from Warrnambool shipped 40 pairs of ducklings by the s.s. "Aberdeen," which realised 7s. per pair, on which he paid for packing and freezing, 13s. 4d.; for ocean freight, 25s.; insurance, 1s. 6d.; landing and warehouse charges, 11s. 6d.; brokerage and commission, 18s.; total, £3 19s. 4d.; which left him a net return of £10 0s. 8d., or a trifle over 5s. per pair. The then Melbourne price was 3s. per couple. The ducklings were of no particular breed. Another farmer sent, in the same vessel, a consignment of Pekins, and got 8s. per couple, and a few others realised 6s. 6d. This exporter in a following vessel sent thirty goslings, which brought 12s. per pair, or about 8s. net. A Mr. Sanger, from Benalla, exported 18 chickens, and realised 8s. per pair, but through some unexplained cause the charges amounted to 3s. 6d. per pair; still, this left him 4s. 6d.—much more than the local price. Ducklings have brought as high as 9s., and as low as 5s.; poultry as high as 8s. 6d., and as low as 4s. 6d., but it should be borne in mind that the above consignments were landed in a season when poultry were scarce and dear; but as a set-off in a small degree the charges are also reduced, and should not now amount to more than 1s. 3d. each for fowls and ducklings, and 2s. each for geese and turkeys.

Speaking generally, in England poultry all the year round are as cheap as in the Colonies, and the only reason why we can at all attempt an export

trade, is that the winter months there are not favourable for hatching, with the result that in March, April, May, and early part of June, chickens and ducklings cannot be had except in small numbers, and with the opposite seasons here, our poultry are the plentiest and cheapest at that time; consequently, there is no reason why we should not largely cater for this trade, which has unlimited dimensions; one fact must be mentioned, should the English winter be an open one, and favourable for poultry breeding, prices go down, as they did during the past season. Still, if producers here would but give more attention to breeds, and breeding, there is no reason why we should not be able to place our poultry profitably on the Home markets, in the months mentioned, irrespective of the temperature of the English winter.

As already said, it is the scarcity of chickens and ducklings in England at particular seasons, which appeals to us, not the scarcity of table fowls, as understood here, which may mean birds from 8 months to any age. In March and April the English markets are stocked with good and fat birds; late hatched in the preceding year, from 7 to 8 months old, and however these may be valued in Australia for the table, in England they are not chickens; certainly there would be a sale for such were they sent Home, but why keep and feed poultry for eight months if a better price can be obtained at from eighteen to twenty-four weeks old? English people at the season noted, will pay a good price for suitable goods, and in the case of chickens they must be under 6 months old, and to this effect, they must be well fed every day of their lives from the time of hatching, and be fat, and in otherwise good condition, when sent to be killed. Nothing under 3½ lb., live weight, should be forwarded, and at from 5 to 6 months old chickens of good table sorts should weigh 6 lb. each. Ducklings should have a minimum live weight of 4 lb., and if Aylesbury or Pekins, or a cross from these varieties be bred, with good feeding, they should weigh 6 lb. at from 3 to 5 months old. The following is the monthly wholesale price, received by Messrs. Brooke Bros., Leadenhall Market, London, during the past year for prime chickens:—

	s.	d.		s.	d.	
January...	3	0	to	4	0	each.
February	3	0	,,	4	0	,,
March	3	3	,,	4	6	,,
April	4	3	,,	5	6	,,
May	4	0	,,	5	0	,,
June	3	6	,,	4	3	,,
July	3	0	,,	3	6	,,
August	2	3	,,	3	0	,,
September	2	6	,,	3	3	,,
October...	2	6	,,	3	0	,,
November	2	6	,,	3	0	,,
December	2	9	,,	3	3	,,

The same firm supply the following for ducklings:—

	s.	d.		s.	d.	
January...	3	0	to	5	0	each.
February	3	6	,,	6	0	,,
March	4	6	,,	8	0	,,
April	6	6	,,	10	0	,,
May	6	0	,,	8	0	,,
June	5	0	,,	7	0	,,

The above were all well-grown Aylesbury ducklings, and young.

Turkeys weighing from 12 to 20 lb. can be profitably shipped to England, but only to catch the Christmas markets, and at that season are worth from 10d. to 1s. per lb. There is little demand any other time, and the heavier the birds the greater will be the price per lb.

Well-grown fat goslings will realise more than double the Sydney prices, which should leave a good margin of profit to the exporters after paying all charges.

Exporting Eggs.

Shipping eggs to England, profitably, was at one time considered an impossibility, the distance and climatic influence being considered barriers to the success of any such attempts. Thanks, however, to refrigerating machinery, they can be landed there not only sound, but in such perfect condition that some of the best English houses have purchased and sold them as new laid. Messrs. Oetzes and Gerritsen, a large London firm who trade extensively in eggs, had a representative in Australia two years ago, who shipped to his firm many thousands of dozens, and the firm reported on them as follows:—"The eggs by the "Massilia" were of good quality, and when opened out presented an attractive appearance, they being carefully packed in cardboard divisions, filled in with dry pea husks. The consignment was carried at 1 degree above freezing-point, and the freight is equivalent to about 3d. per dozen, which left the net return of 9d. per dozen."

The local price at the time of shipping was 5d. to 5½d.

Eggs, to realise the best English prices, must be clean, of the same size and colour, and forwarded perfectly fresh, for on the latter depends entirely the manner in which they open out. An egg or eggs put into the cool chamber, and kept an indefinite time, at a temperature slightly above freezing, when brought out, will be in exactly the same condition as when put in, whether the time be months or years; hence, to cultivate a new-laid egg trade with England, it is absolutely necessary that they be perfectly fresh when forwarded to the cold stores, and, like poultry, they must be shipped to reach England in the dearest time for such products, which, in the case of eggs, is November, December, and January. After the latter month home prices fall to such an extent that exporting becomes unpayable, and as supplies to our own markets are then becoming limited, and prices going up, the egg-producer will have good remunerative returns throughout the year.

In conclusion, I might say no one should run away with the idea that he, or she, can make a fortune by poultry-breeding any more than they can by making the most of the other adjuncts of the farm, but I do say that if farmers give the same attention to their poultry as they do to the other stock of their farm that the results will be beyond anticipations. Also bearing in mind that no matter how largely the industry may increase, the export trade can always be relied on to relieve our glutted markets, and the success and profitableness of the business, whether for the local or English markets, depends upon good management and adherence to a few simple essentials given herein, which, if at all complied with, might raise poultry-breeding to a great national industry.

The Curing of Meats.

THE following information with respect to the curing of meats is from the last annual report of the Bureau of Animal Industry of the United States Department of Agriculture.

An inquiry concerning the famous Smithfield hams was recently received by the Department of Agriculture, Washington, and the information desired was deemed of sufficient importance to warrant the sending of a special inspector to make an investigation as to the especial merits of this product, the process of manufacture, and the causes from which its excellence is derived. The report of the inspector is given in full below :—

The celebrated "Smithfield ham" gets its name from the little town of Smithfield, which is located on Pagan Creek, about 30 miles from Norfolk, V.A. About one hundred years ago a gentleman by the name of Todd began to cure the meat, *i.e.*, hams and bacon from the almost wild hogs that were allowed to run in the extensive forests surrounding Smithfield.

The fame of the hams thus produced spread; consequently the business of producing hams extended. The business has descended from one generation to another, and has been perfected, until the only rival to the Smithfield ham is the celebrated Westphalia ham, which is considered by many to be inferior to this product.

There are numerous producers of the genuine Smithfield hams, and they have many imitators. The principal packer of these hams is Mr. E. M. Todd. He puts up about 12,000 hams annually. Mr. J. O. Thomas is probably the next largest packer.

Unlike Mr. Todd, Mr. Thomas raises a good many of the hogs he uses. He has a farm of about 2,500 acres. A large part of this is heavy woodland, and in these woods his hogs run almost wild. All the farmers raise hogs to some extent. Most of them sell their hams "green," that is, uncured, to the packers, who, in most cases, are farmers upon a larger scale. The hams thus bought are very carefully selected, all those not coming up to a certain required standard being rejected. The standard price paid last fall for green hams was 14 cents per pound, delivered at the smokehouses.

There are several things necessary in order to produce a Smithfield ham.

1. *The kind of hog used.*—It is impossible to make a good ham from a Western hog. By that I mean a ham with the peculiar qualities of the Smithfield. The demand for these hams has grown to such an extent that some of the packers have been tempted to try hams from other parts of the country. Mr. Todd, and also Mr. Thomas, purchased some of the Western hams; and, by curing them with care, tried to make them like those grown near Smithfield, but they failed to give satisfaction. They even tried to purchase the live hogs, and kill them themselves, but then they were not like the home-grown animal. The hog from which the ham is produced is the unimproved, half-wild "razorback" hog that is peculiar to the mountainous portions of Virginia, Kentucky, and Tennessee. I asked this question of numerous farmers and packers :—

"Why do you not use the improved breeds of hogs at least for crossing with your 'razorbacks' and get an animal with less nose, shaped more liked a hog and less like a racehorse?" The unvarying answer was, "We have tried it and nearly spoiled our hams. The grain is too coarse, and the shape of the ham is not the same. We want the long-nosed, slab-sided, long-legged rooter." These hogs appear to be nondescript in breeding; they have extremely long noses, are very thin-sided, deep-chested, with small flanks and extremely long, sloping hams.

They show the attempts that have been made to improve the breed by the variety of colours and marks seen among them. Many of them are black, with no white. Some are white. The majority are spotted black and white, while not a few show black, white, and red mixed irregularly, and many are a peculiar iron-gray in colour.

2. *The manner in which the hogs are fed.*—I visited a number of farmers who are successful producers of these hams, and from them I find a singular similarity in methods. The sows run at large in the woods, and pig about the 1st to the middle of April. From the manner in which the hogs are kept, however, the time of pigging is not easily controlled. The pigs run during the summer months in the woods, living upon the nuts and roots which they can secure. They are not fed on anything to make them fatten. Most farmers give about one ear of corn night and morning to each hog in order to "keep them to the call." In the fall, when the corn crop has been gathered, the hogs are turned into the corn-fields. In these fields every other row has been planted to "black-eyed" peas, and the hogs are allowed to gather these and the small corn that has been left in the field. When turned into these fields they are very thin. The feed they get there causes them to begin to fatten rapidly. As the potatoes are gathered the hogs are allowed to follow in these fields, and get those that are left. In that district which produces the most Smithfield hams, there are a great many sweet potatoes and peanuts raised, and the hogs are allowed free access to these fields as soon as the crops are gathered.

This method of feeding fattens very rapidly. The potatoes, and particularly the peanuts, add fat with astonishing rapidity; but the fat is very soft. Peanut fat, in particular, has a translucent, oily character, which, from its tendency to drip when the hams are hung up, causes a great shrinkage in the weight.

After the fields have been cleaned up in this manner, and before the hogs can "go back" any in their fattening, they are taken out of the fields and put into close pens, and fed on corn and clean water. The pens are made dry with good shelters on the northern exposures, and a chance for plenty of sunlight. The hogs are plentifully bedded with pine straw, gathered from the woods, and fed all the corn they will eat, and given all the clear water they want. When the hog is penned his days for wallowing are over. From this time until slaughtered he lives a life of enforced cleanliness. The hogs are kept in this feeding pen until just the right condition is produced. They must not be too fat nor too lean. Many of the larger hog-raisers inform me that they frequently have several killings from the same fattening pen, some getting into condition sooner than others; and, as they do, being culled out and slaughtered, the rest remaining for a longer time until just the right condition has been attained. All were positive in the assertion that "swill feed" spoils the hams, and that corn was a necessary article to finish the product in order to produce the best hams, while all were equally positive that it was impossible for them to buy hogs from the West—by that, meaning anywhere away from their immediate vicinity—and produce the same quality of meat, even if they kept them long enough to fatten them themselves. These hogs, when fat, weigh about 125 to 190 pounds as the extreme limits; larger hogs are not considered desirable.

3. After fattening, the hogs are carefully slaughtered. In this, as in all the other processes, great care is used. The animals are carefully handled to prevent bruising, and are carefully bled. The most particular part of the killing process is cutting up the meat. The hams are the first consideration. They are very carefully cut out, care being taken to trim them so as to leave the tissues in the ham proper intact. The "hock" joint is left long. The hams are not cut close, care being taken to leave all the connective tissues possible at the "upper" end to prevent as much as possible the hams from dripping when hung in the smokehouse.

4. The next important process is curing. Mr. Todd, who cures more than any other one man in Virginia, kindly gave me his whole process. His method is the same as used generally in the South, which is noted for its production of superior pork. In an article on "Something about Hams," in *Leslie's Illustrated Weekly*, August 16, 1894, Philip Poindexter gives Mr. Todd's method in full, and Mr. Todd assures me it is correct. This method is the one employed by all the producers of Smithfield hams. It is as follows:—

1. The hams are placed in a large tray of fine Liverpool salt. Then the flesh surface is sprinkled with finely-ground crude saltpetre until the hams are as white as though covered by a moderate frost; or, say, use 3 to 4 pounds of the powdered saltpetre to 1,000 pounds of hams.
2. After applying the saltpetre, immediately salt with the Liverpool fine salt, covering well the entire surface. Now pack the hams in bulk, but not in piles more than 3 feet high. In ordinary weather the hams should remain thus for three days.
3. Then break bulk, and resalt with the fine salt. The hams thus salted and resalted should now remain in salt in bulk one day for each and every pound each ham weighs; that is. a 2-pound ham should remain two days, and in such proportion of time for larger and smaller sizes.
4. Next, you wash with tepid water until the hams are thoroughly cleaned, and after partially drying rub the entire surface with finely ground black pepper.

5. Now the hams should be hung in the smokehouse and this important operation be begun. The smoking should be very gradually and slowly done, lasting thirty to forty days (most packers using green hickory or red oak to smoke with).
6. After the hams are cured and smoked they should be repeppered to guard against vermin, and then bagged. These hams improve with age, and may be considered perfect at about one year old.

The conclusion naturally to be drawn from these facts is that any ham treated as these packers treat theirs would be better than the average. The Smithfield ham, however, owes its popularity to its peculiar flavour, and this flavour is not due to the manner in which it is cured, else any ham cured in the same manner would rival it. It does not owe its flavour to the manner of feeding altogether, else hogs from other parts of the country could be brought here and perfected. The necessary things in the opinion of the producers may then be summed up as follows :—

1. A slow-growing, peculiar-shaped hog.
2. A peculiar game flavour produced by the wild life in the woods and the nuts, berries, etc., upon which it lives.
3. Rapid production of flesh when the fattening process begins. The fat formed of corn and pure water.
4. The method of curing and smoking.

All these points seem necessary to the production of these hams.

It would be of interest to know if the hogs produced in southern Kentucky and parts of Tennessee would not produce these hams. The hogs in many parts of these States are raised in the same manner, except in the process of fattening, and to all appearances are the same hog.

Undoubtedly many hams are sold as Smithfield hams which are produced in other parts of the country, and which are inferior in many respects to the genuine article. The supply is limited and the demand is great. Very few of those produced are sold to the trade. Mr. Todd is the principal packer. He buys his hams whenever he can get those that are suitable. He assures me that he cannot get hams outside of four counties in Virginia that will answer his purpose at all. Isle of Wight, Surry, Southampton, and a portion of Nansemond counties, Virginia, produce all the hams that are the genuine Smithfield.

Mr. Todd	About 12,000
Mr. J. O. Thomas...	,, 2,500
Mr. M. F. Loughron	,, 2,000
Capt. O. G. Delk	,, 1,000
Mr. Chapman	, 1,500
Other local dealers	,, 1,000
A total of about	20,000

sold from Smithfield and vicinity.

There are probably one-third more sold by various farmers who cure them in a small way, making a total of about 30,000 hams which are produced annually, and which are the genuine Smithfield hams.

These hams average when cured about 10 lb. in weight : some are a little heavier. while perhaps the greater number weigh rather less. At 10 lb. the total output would be 300,000 lb.

They sell in the smokehouses at about an average price of 20 cents per pound, some packers, like Mr. Thomas, getting an average of 22 cents for their whole product. This makes an annual income of about \$60,000 from hams alone to be distributed among the farmers of Isle of Wight, Surry, Southampton, and Nansemond counties. This territory could undoubtedly raise many more hogs.

The output could be doubled many times were the farmers not afraid of losses from hog cholera. As it is, most of the farmers raise a limited number of hogs, knowing that they have a ready sale for their hams either cured or green, and have their other crops "to fall back on" should hog cholera break out. I found the largest number raised was about 200 head, while almost every farmer has a few. Mr. Todd sells his hams on orders received before the crop is cured. He supplies a limited trade in the principal cities of this country and sends some to England and France.

Mr. Thomas sells his whole output on private orders, selling none to the trade. His principal market is family trade in Boston- New York, Philadelphia, Washington, D. C., San Francisco, and he receives orders from private parties in Europe and the Sandwich Islands.

Many of the smaller producers sell their hams in this manner, while some others trade theirs at the stores for groceries, or sell in small lots to commission houses in various near-by cities.

The rest of the meat, viz., the side pork and shoulders, is in most instances cured in exactly the same manner as the hams, and used by the farmers to feed their field hands, or to furnish breakfast bacon for the local trade. The sides make very desirable bacon that is much sought after among the negroes and in the small towns. The farmers who sell their hams use most of the side meat to feed the families of their farm hands, although some of it is sold in the markets. The breakfast bacon from these hogs is peculiarly sweet and is much sought after by many. It is impossible to say how many parties are engaged in the production of these hams without taking a census of the farmers in the counties referred to, but the principal packers are the ones named.

In the above report, full details have been given, including the names of the packers, in view of the limited and comparatively local trade affected and of the value of presenting for the information of pork breeders generally some of the nice points involved in the production of superior and high-priced pork.

Other inquiries in regard to the processes in use in the United States of curing meats, particularly hams, suggested the utility of extending like inquiries to other places. Letters were addressed to inspectors of the Bureau of Animal Industry at the principal packing houses of the country, asking them to obtain for comparison the formula used by the packers in preparing such products for the market.

In a comprehensive report concerning the curing of hog products in a Western packing plant the feature of especial interest embodied is a description of the process of pickling by injection.

The curing of the meat commences when fresh-slaughtered swine are placed in a chill room, the temperature of which is 40° F. at the start, gradually falling to 28° F. thirty-six hours later.

After remaining in this condition forty-eight hours, the carcasses are removed to an adjoining room, where they are cut into such sizes and shapes as the quality of the meat or the demands of the market require. From the cutting bench the meat passes to the curing rooms below, where it is then exposed to the action of the following-described pickle:—

Formula for curing hams, shoulders, bacon, dry salt meat, and mess pork.

	Parts.
Chloride of sodium (salt)	78
Saccharine (sugar)	28
Nitrate of potash (saltpetre)	20

Use of pure water a sufficient quantity to make a 78 per cent. solution.

Hams and shoulders are first injected with this solution. The process is as follows:—A hollow needle, 10 inches long, to which is attached a rubber tube connecting with a small vat containing the pickle, is inserted three or four times in different parts of the ham. At the same time a lever is lowered which forces the liquid through the needle into the depths of the ham. The ham is then placed in the pickle, where it remains for ten days. It is then removed and the injecting process repeated.

Large hams weighing 20 lb. or more may require a third injection. Two injections and sixty-four days in large vats, submerged in the above pickle, completes the cure, with the exception of smoking.

This consists in placing the meat in a close, dark room, where it is suspended from the ceiling. It is then subjected to a dense smoke caused by the destruction of hickory or ash wood by heat for twenty-four to forty-eight hours, the former being considered a mild cure.

Bacon is first injected with the pickle in the same manner as the hams, after which it is placed in large vats and entirely submerged in the pickle.

At the expiration of ten days the injecting process is repeated, when the meat is again returned to the vats. In about sixty days the curing is completed, with the exception of the smoking, which is conducted in the same manner as with the hams.

Dry salt pork is first injected with the pickle in the same manner as the other-mentioned products. After receiving the injection it is merely dipped in the solution. While still damp it is thoroughly hand-rubbed with salt. It is then laid on the floors of the cellar, where it lies for ten days, at the end of which time the injection is repeated, as well as the dipping and hand-rubbing with salt. In heavy meat the third operation is necessary to thoroughly cure the meat, which is accomplished in ninety days.

Mess pork is cut into convenient sizes and pieces, and packed firmly in barrels made for the purpose. The pickle used in the other kinds of meat above described is then poured into the barrel until it is filled, when it is headed.

In sixty to ninety days the curing is completed. The difference in time required is due to the thickness of the meat.

The following formula is the one in use by a large New England packing house:

Hogs to be well cooled off before cutting. Hang forty-eight hours in 35° temperature. For a tierce, 300 lb. of hams, 18 lb. of salt, 1 lb. saltpetre, 7 lb. sugar. Fill the tierce with water. Keep in a temperature of 38° to 40°. Overhaul twice a week, or oftener, if case requires, for four weeks. Will be ready to smoke in sixty to eighty days, as to size.

Hams from well-cooled hogs, use 8 lb. salt, one-fourth of a lb. saltpetre, 2 lb. sugar for 100 pounds meat.

Medium-sized hams will be cured enough to smoke in forty-five days if kept in a temperature of 38° to 40°.

Incidental to a description of the method of curing meats both by the "dry-salt" and the "pickle" cure, another report explains the process of the manufacture of "California," "boneless," and "cottage" hams:

The hogs after being slaughtered are left in the cooling room about half an hour. The carcasses are then put into a room whose temperature is about 44°, and left there for about six hours or until the animal heat has left them. They are next transferred to another room, the temperature of which is 32°, and left there for twenty-four hours. From here they are taken to the cutting room and cut into special pieces, the quality of the hog and supposed condition of future trade (when cured) governing the kind of cuts made out of the carcasses. For instance, three kinds of so-called hams are made from shoulders, viz., California, cottage, and boneless hams. They are made as follows: The shoulder is cut in two and the upper part cut round to resemble a ham. This is called a California ham. The lower part, with the leg cut close off and part of the shoulder left in, is called a cottage ham, and when the shoulder blade is taken out it is called a boneless ham.

Then we have the genuine hams made out of the hind quarters. They are called long-cut hams when the shank is left pretty long, and short-cut when left short. They are divided into three grades—light, medium, and heavy. They are cured by two methods, viz., first, dry-salt cure; second, pickle. It appears that by the latter method the packer gets more weight out of his product.

Dry-salt cure.—About ½ oz. of saltpetre (nitrate of potash), ½ oz. of sugar, and 1½ lb. of common salt to each ham, rubbed in. They are then put in the cellar and left from five to seven days, when they are turned over and left for about twenty-eight days. They are then cured. Heavy hams and summer weather will take a few days longer.

Cured in Pickle.—The strongest pickle registers 24° by the pickle tester. You cannot make it any stronger, as the water will not dissolve any more of the ingredients. What s called mild cure registers about 16°. It is made as follows: 8 oz. of saltpetre, 3½ lb. of sugar, 21 lb. of salt, and 12 gallons of water. This is sufficient for 1 tierce. The tierces contain 280 lb. of ham. They are rolled around every day for fifteen days to keep the pickle from settling, and the hams are cured in from thirty to thirty-five days.

If not called for before ninety days, the pickle is drawn off, the hams are taken out of the barrels, piled in cold storage, and a sprinkling of borax thrown on them. If they are to be shipped, fresh pickle is put on them, and it is generally of 20° strength.

The other cuts, such as bellies, sides, backs, and shoulders, are cured in the same way, excepting that the sugar is generally left out of the formula. Saltpetre is left out in curing what is called a French back. Dry-salt-cured meats when shipped are sometimes packed in borax and sometimes in salt.

Smoked meats.—After being cured they are put in a vat and washed. Then they are put in a smokehouse and smoked with hickory wood from thirty-six to forty hours. Sometimes they are shipped in bulk, sometimes packed in boxes. Sometimes they are sewed up in a covering with a gaudy brand on it and sold to the trade.

The report from another abattoir in the same locality shows only a slight difference in the treatment of the hog products:

The hogs are left about six hours in the cooling room, as there is no intermediate room. The chill room is always down to 32°, so the animal heat must be allowed to leave the carcasses before putting them into so cold a place, or they would freeze on the outside and spoil in the centre. When any meats begin to get old, borax is used very liberally, and when dry-salt-cured meats are shipped they are very often packed in borax.

A statement of the methods which have been adopted by another packing company in curing various kinds of meats is furnished in the following:—

Barrelled beef.—Chilled at 40°; carried in brine pickle 70° strength, using 2¾ oz. saltpetre to 100 lb. beef. This is used for all such things as mess beef, plate beef, &c.

Beef hams.—Chilling temperature 40°. After chilling carry in 70° strength brine pickle; use 3¼ oz. saltpetre to 100 lb. beef; 2 pints of syrup to 220 lb. beef.

Beef, hog, and sheep tongues.—Use 70° strength brine pickle; 3 oz. saltpetre to 100 lb. tongues; cure in temperature of 40° to 45°.

Pork hams.—To 100 hams, 2 lb. 11 oz. best granulated sugar, 3 oz. saltpetre, 4 oz. borax, sufficient salt to raise 5¼ gallons of water to 75° strength. Salt, sugar, &c., are well dissolved before mixing, and filtered into the pickle.

When chilling hogs, hold coolers at 32° to 34° temperature; leave hogs in coolers forty to seventy-two hours; after cutting, rack the hams in a room at 32° to 34° for twenty-four hours, after which pack in above pickle. At the age of 60 days the pickle shows a strength of 53° to 54°.

Dry-salt meats.—Hogs are chilled as stated under the heading of "Hams." After being cut the salt meats are piled up in a dry salt with a very light sprinkle of saltpetre. They are overhauled at the end of five, fifteen, and thirty days. During curing they are kept in a temperature of 40°.

Special reference to a difference in treatment of meats designed for foreign or domestic trade is made in the system of curing given below:—

After slaughter, the carcasses are allowed to hang in a cooling room for about forty-eight hours before being cut up, and as each piece is trimmed it is immediately consigned to the cellar. Those pieces destined for the dry-salt cure are well rubbed with salt and packed on the floor in layers six to twelve high. In about ten days more they receive another rubbing of salt and are packed as before, and again in fifteen days the process is repeated, after which they are allowed to stand in bulk until they are cured, which takes about forty-five days.

To English meat a little saltpetre is added.

For pickling hams the following is the formula, the quantities named being sufficient to cure 280 lb. of meat, and its strength as indicated by the salimeter is 80°:

English salt	21 lb.
Saltpetre	1 ,,
Sugar	4 ,,

Water sufficient to fill the tierce in which the meat is placed.

The tierce is then closed, and for the first three or four days it is rolled round daily three or four times to ensure an equal distribution of the pickle. Every three or four days thereafter the process is repeated, the time required for curing varying, according to the size of the hams, from forty-five to eighty days.

At this stage the meat can be supplied to the trade, but for certain kinds of trade, especially the domestic, it has to undergo the process of smoking for from twenty-four to thirty-six hours. Breakfast bacon and other pickled meats are treated in a similar manner and require from twenty to forty days in curing.

Two processes in use at one packing house, denominated the "salt cure" and the "sweet-pickle cure," are thus outlined :

There are two methods of curing, one called the "dry-salt cure" and the other the "pickle cure." In the former, after the meat has been sufficiently cooled so as to get out the animal heat, which generally takes from twenty-four to forty-eight hours, according to the season of the year, the meats are well rubbed in salt and bulked on the floor, usually from six to ten high, and resalted again when they are about from three to five days old and left lie until they are about twenty days old, when they are resalted once more, being bulked higher each salting, so as to not take up too much room, and left in the bulk until it is fully cured, which usually takes about from forty-five to fifty-five days, according to the size of the meat, The extremely heavy meat would of course take sixty days in order to get it fully cured. We use nothing but Kansas salt in the dry-salt cure, except a small amount of saltpetre for the shoulders.

For the sweet-pickle cure the meat is handled in the same manner, except that instead of being cured in bulk it is cured either in large vats or tierces. It takes about the same length of time to cure in pickle that it does in dry salt. The sweet pickle is a brine which is made from Kansas salt, with a small portion of saltpetre and borax added, and a sufficient quantity of syrup to give it a sweet flavour.

A brief sketch of the operations and curing process of a great packing house reads :

After the hogs are killed they are run on rails into a chill room, usually at a temperature of 38° to 40°, for about twenty-four hours. Next day the temperature of the chill room is reduced to 32°, and the hogs are left there for twenty-four hours more ; that is, forty-eight hours before being cut up into the various cuts as the trade demands. After the hams are chopped or sawed off the side of hogs they are trimmed and dropped down a chute into the curing room, where they are sized and sorted according to quality of six different grades. They are then trucked out into a spreading room, 32° temperature, where hams or shoulders are each separately spread on lattice racks or hung on hooks for twenty-four hours at least. They are then taken and weighed into oak hogsheads containing 1,300 to 1,500 lb. of meat, or into tierces of 300 lb. each, and pickled with brine 60 to 80 per cent. strength, to which solution of salt and water is added 2 lb. of pure cane sugar and 4 oz. of saltpetre to the 100 lb. of meat, and then tightly pressed down underneath the pickle to keep air-tight. It is then overhauled or taken from one hogshead and placed into another four different times so that the pickle may reach all parts of the pieces of hams or shoulders ; also that it can be evenly and uniformly cured, which takes from sixty to ninety days, according to the weight and size of the pieces of meat.

A process dissimilar in some details from the preceding was outlined by another correspondent, viz.:

The hogs after being dressed are hung up in the chill room, cooled by artificial cold, the temperature being about 34° to 38°, not less than forty-eight hours, and when thoroughly cooled are made into the various cuts. The regular American cut ham for sweet pickling is then put into vats or tierces, and to every tierce of 300 lb., or its equivalent in the vat, we use three-quarters of a lb. of East India saltpetre, half a gallon sugarhouse syrup of high grade, and 27 lb. of salt. This is partly made into a pickle and partly put into the tierce dry ; when tierces are used, the tierce is moved after being packed, say six or seven days, for the purpose of giving the hams a more uniform cure or preventing salt from settling and remaining at bottom of tierce. If cured in vats, the hams are removed from one vat to another and brine poured over again, this for the purpose of mixing the brine and keeping it uniform throughout the vat ; the hams being kept in cold storage in temperature of 34° to 38° for a period of forty-five to sixty days. Sweet-pickle meats—that is, shoulders and bellies—are treated the same way. The meats for dry-salting, being chilled as aforesaid, are put into cold storage in bulk, and same amount of saltpetre is used with them as in the sweet-pickling, one-quarter of a lb. to 100 lb., and then they are banked in salt. The amount of salt used depends on the length of time they are kept in bulk before shipping. These are resalted from time to time, they being restacked at intervals, until they are ready for shipping. It is difficult to tell the exact amount of salt, they having to be entirely covered when in process of curing, the salt having to be swept off before shipping and packed with fresh salt. The sides remain is salt not less than thirty days, and if heavy a longer period ; the hams and shoulders forty-five days and upward, according to the size of pieces. These must remain in this condition until sold and shipped, sometimes remaining some months.

A description of the methods of curing hams, making barrel beef, shipping sweet-pickle meats, and preparing fresh canned meats is embodied in the following:

After the hogs are killed they are hung in the cooler forty-eight hours or more, until the temperature of the meat in the centre is 40° F., or cooler. The hogs are then cut up and the hams or shoulders are placed in a cooler at about 30° F. for forty-eight hours or longer. Three hundred lb. of hams are usually placed in a tierce; for one tierce of hams 24 lb. of Saginaw salt, 12 oz. nitrate of potash, and 5 lb. Louisiana sugar. The tierce is filled with water. For pickling in vats the same proportion of ingredients is used. Sixteen-lb. hams cure in sixty days at a temperature of 40°. After packing, the barrels must be rolled once every two weeks in order to detect leaks and equalise the pickle. In some cases the pickle is injected into the hams in order to hurry the process. By this method a pickle can be effected in about thirty-five days. This, however, is not the usual practice. I find that the proportion of ingredients varies, some according to whether they are making a mild or strong cure. For meats going into hot countries strong pickle is usually used, and in smoking the same is the case.

In making barrel beef they usually put 200 lb. of beef in a tierce. One peck of coarse salt is put in the bottom of the barrel. The pieces are rubbed with fine salt and packed. Eight oz. of nitrate of potash is added, together with 1 peck of coarse salt on the top of the barrel. The barrel is then filled with a solution of salt 100° strong. The barrel is rolled once a week and is considered cured at the end of four weeks. It is kept in cold storage about 35 or 40° F.

In shipping sweet-pickle meats, it is usually the custom after they have been removed from the pickle and dried, to rub them with finely powdered borax. They are then packed in boxes and shipped in that condition, although they are often shipped in salt and in pickle.

In curing dry-salted meats the meat is thoroughly rubbed with salt and packed in piles in cold storage of about 40°. It is handled about once every two weeks, when it is unpiled and rubbed again with salt and repiled, that on the top being placed at the bottom and vice versa. The moisture of the meat furnishes the water for the pickle.

Fresh canned meat is first cooked in boiling water for from one-half to three-fourths of an hour. It is then placed in cans and is cooked again in steam retorts 240° F. from one to three hours, according to the size of the can. It is then taken out of the retort and the can opened to allow the escape of air, water, etc. It is then resealed and cooked a second time at the same temperature and for about the same length of time. The cans which seem to contain air after the second cooking are agained opened and sealed. Salt canned meat is also cooked in this manner. A secret process is used for preserving hog livers. Livers cured in this manner are shipped to Germany and are said to present an almost fresh appearance upon their arrival. The shippers, who are Germans, preserve the livers themselves, but will not reveal the secret of the pickle.

A formula submitted to the Department for sugar-curing hams is as follows:—

Sugar pickle.

Salt	200 lb.
Crude saltpetre	5 ,,
Sal. soda (carbonate of soda)	7 ,,
Syrup, or New Orleans molasses	9 gallons.
Water sufficient to make	120 ,,

First, have your hogsheads, to contain 120 gallons of pickle, in good order and wel cleaned. Then have a few hogsheads separate from the others in which you make and prepare your pickle. Weigh off the 200 lb. of salt and place it in the hogshead and fill up with water until the same is two-thirds full, constantly stirring until the salt is entirely dissolved. For each 5 lb. of saltpetre and 7 of sal. soda, pounded up and placed in an iron kettle, add 2 gallons of water, and with a slow fire simmer until the ingredients are all dissolved. Take 3 gallons of this solution, and put into every hogshead of brine you have thus far prepared, and should there be any remaining, divide it up *pro rata* among the hogsheads, keeping up a constant agitation until the whole is thoroughly incorporated. Lastly, take 9 gallons of molasses and add it to each hogshead of pickle, constantly stirring until the saccharine matter is perfectly mixed, and should the cask not be entirely full, add water sufficient, and the brine will be ready for use.

Then take the hams as cut at the block and sort or divide them into three different sizes, viz., small, medium, and large. As they are delivered at your salt-box, take each ham separately and plunge it shank downward into the salt, flesh side up, over which you sprinkle about half an ounce of finely-ground saltpetre. With the palm of your

hands rub the saltpetre thoroughly into the meat, and in like manner afterwards the salt. You then pack into the cask, shanks to shanks, and butts to butts, until the same is full, placing the butts of hams downward first, and so on alternately until the hogshead contains about 850 lb. The hams, or whatever kind of meat you are packing for cure, are to be braced down, so that they will not float or rise to the surface; have each size packed in hogsheads separate, then pour the pickle over the meat until the cask is full, and the meat entirely submerged.

In this condition you let the hams remain five or six days, then overhaul or change from one cask to another, packing them as already described, and fill up the cask with the same pickle. Continue this overhauling for three consecutive times, at intervals of five or six days, and then let them remain undisturbed until perfectly cured. Allow small hams to remain in pickle, thirty days; medium, forty-five; and large, sixty days.

On removing the cured hams from pickle, dip or wash them in hot water, allow to partially dry, and finally smoke them for eight or ten days. Green hickory has been practically demonstrated to be best for smoking.

Shoulders, breakfast bacon, and all other pork products are treated in the same manner.

The following process differs in no important respects from the general principles of several of the preceding formulas:—

Hogs, when killed, are first placed in the dry room, and after remaining there from three and a half to four hours they are put into the chill-room, at a temperature of 28 degrees to 30 degrees Fah., for from forty-eight to sixty hours. They are next cut up into sides, hams, shoulders, &c., ready to be cured.

Dry-salted meats.—Sides are packed in dry salt, and after fifteen days are turned and re-salted. The complete curing process requires from forty to fifty days.

Long hams are packed in dry salt with 4 oz. of saltpetre to the hundred-weight of meat. These are not re-salted, and are cured in about thirty days at a temperature of from 36 degrees to 38 degrees Fah.

Meats for export are packed in borax.

Pickled meats.—Hams and shoulders when taken from the cutting-room are replaced in the chill-room; they remain there from twenty-four to forty-eight hours, so as to be thoroughly chilled. They are then packed in an 80 per cent. salt solution with 4 oz. of saltpetre, and 1½ lb. of sugar to the hundredweight of meat. After eight days the meat is turned in the barrels in which it is packed, so that the salt will be thoroughly distributed. It then remains undisturbed until cured.

Picnic hams and shoulders require from sixty to sixty-five days and hams from eighty to eighty-five days to cure.

Mess pork is cured in a 100 per cent. salt solution, and from 18 lb. to 20 lb. of rock salt to the hundredweight of meat.

Another packing company submits its process of curing meats in the following terms:—

Beef hams, cut into regular sets of three pieces, viz., the outside, inside, and knuckle pieces. After being thoroughly chilled, weigh 220 lb. to the barrel, add 70 degree salimeter-test pickle, 10 oz. saltpetre, and 3 pints of syrup. After forty days' cure it is ready to be smoked.

Plate beef.—The plates cut in three pieces—brisket, navel, and rib; pack 200 lb. to the barrel; use 30 lb. coarse capping salt, 100 degree pickle, 10 oz. saltpetre; plain cure.

Extra mess beef.—Same cure as plates; meat used—chucks, plates, flanks, and rumps; 200 lb. to the barrel.

Canned beef.—Plain cure; 75 degree pickle, 6 oz. saltpetre per cwt.; after twenty-five days' cure, ready to can.

Pork hams, sugar cured.—After being well chilled they are rubbed with fine salt and left standing up in the cooler over night. Pack them 300 lb. to the tierce, 68 degrees strong pickle, 5 lb. granulated sugar, or 3 quarts of Washington butcher syrup. Time for curing, fifty days.

Shoulder and bacon.—Same cure as hams.

Short ribs.—Cured in dry salt, forty days, ready for shipment; fifty days ready for smoking.

The following is a formula generally in use for curing standard meats at another abattoir:—

23 lb. salt, ¾ lb. saltpetre, 3½ lb. sugar, to 300 lb. green meats.

The hams are then kept in a temperature of about 36 degrees to 40 degrees for a period varying from seventy to ninety days, when they are ready for smoking. They can be smoked in about from two to three days with hickory wood and sawdust used as a fire.

Dry-salted meats are cured with dry salt, and about the same proportions as stated above of saltpetre and sugar. They are kept in process of curing, varying for the time of year, from thirty to forty days, when they can be smoked and put on the market. The usual time for smoking dry-salted meat is from two to three days with hickory wood and sawdust.

The above formulas would cover all meats which are put in pickle of such as hams, shoulders, &c.

Mess pork is cured with full strength brine and topped off with clear rock salt.

Another correspondent writes:—

There are so many varieties and different ways of curing the differents cuts of meat that it is almost impossible for us to know where to begin to give you the information you desire.

The time of curing hams depends upon the size of the piece of meat. It takes from forty-five to ninety days to cure a 12-lb. to a 20-lb. ham. The hogs, immediately after slaughtering, are run into a chill-room, where the temperature is about 32 degrees twelve hours after killing, which temperature is now down to 25 degrees to 27 degrees thirty-six hours after killing. When the hogs are cut up, the hams are spread on shelves in a temperature of 25 degrees to 28 degrees. They are allowed to remain in this temperature twenty-four hours, when they are taken out and put in pickle made of salt, syrup, or sugar and water, and allowed to remain in this pickle from forty-five to ninety days, depending upon the weight of the meat. These hams are taken out of pickle after being cured, and are either shipped to foreign countries, rubbed in borax and packed in boxes, or smoked and sold to the domestic trade.

Especial importance is attached in the succeeding formula to the "cutting" of hams with reference both to shape and weight.

Hogs when dressed hang from forty-five to forty-eight hours in an average temperature of about 35 degrees. They are then cut up and the hams shelved for about twenty-four hours in a temperature of about 35 degrees, when they are placed in pickle and cured for about sixty days before being smoked.

Standard sweet-pickled hams should be cut short and well rounded at the butt, properly faced, shank cut off enough above the hock joint to expose the marrow; to be reasonably uniform in size, and to average in lots not to exceed 16 lb., with no ham to weigh less than 12 lb. and none to weigh over 20 lb.

300 lb. block weight shall be placed in each tierce, with either 22 lb. salt, 3 quarts of good syrup, 12 oz. of saltpetre, and tierce filled with water, or tierce filled with sweet pickle made according to above standard.

The treatment of the hog and its product from the time of delivery to the packing company until ready for market is briefly outlined in the subjoined:—

Hogs used for packing purposes are well fed and watered from three to five days after delivery, then slaughtered and hung in cooler for forty-eight hours. They are then cut into different parts, which are also hung in cooler for forty-eight hours more, placed in tubs in cooler with brine composed of water, salt, saltpetre, and syrup, and left there from sixty to eighty days. They are then taken out, smoked, and sold to the trade.

Reference to the importance of allowing the animal to become thoroughly cooled before slaughtering prefaces the process of curing in use by another packing company:—

Allow all hogs to rest for twenty-four hours in a pen, in order to have them thoroughly cooled out before killing. After hogs are killed and thoroughly chilled (it takes at least forty-eight hours), they are then cut up into the different cuts of either hams, shoulders, bellies, or sides.

The hams, shoulders, and bellies are cured in sweet pickle, which is composed of sugar, salt, saltpetre, and water, thereby making a brine. The meats are packed in a tierce, covered with this brine, and are then allowed to remain in cure from forty-five to sixty days, the same depending on the weight before being smoked.

After these meats are smoked they are ready for the trade. The dry salt meats are packed in cellars in piles, and between each layer of meat is thoroughly sprinkled a large quantity of salt. They are then allowed to cure from twenty to forty days, depending on size of meat, and after being thoroughly cured in this manner they are ready for the market.

Another response to the inquiries of the Department, different in few particulars from the above, is :—

All hogs are allowed to rest in pens from four days to one week before being slaughtered. After they are slaughtered they go in chill-room from forty-eight hours, then are cut in different parts, and these are put in chill-room room for forty-eight hours more. Hams, shoulders, and bacon are then packed in tierces, and a pickle composed of salt, saltpetre, and syrup is put on them. They are left in this pickle from sixty to eighty days, then taken out, smoked, and sold to the trade.

This formula, used by a Western packing company, has been submitted :—

For sweet pickled meats take a pickle of 90 degrees Baumé test, and add thereto the usual amounts of saltpetre and granulated sugar. The joints placed in this pickle are shifted two or three times during the process of cure, and are kept in the pickle from fifty to ninety days, in accordance with the weight of the product : or, in other words, for picnic hams about fifty days, for New York shoulders about sixty days, and for hams from seventy-five to ninety days, in accordance with their average weight.

For white-brine cure the process is similar, excepting that a clear pickle of 100 Baumé test is used on the meat with the addition of a little saltpetre without the sugar.

A receipt for curing meats both in pickle and dry salt is as follows :—

To 1,000 lb. hams thoroughly chilled make a pickle of the best Liverpool ground salt of 85 degrees strength, to which add 15 lb. granulated sugar and 10 oz. saltpetre. For dry salt meats use the same proportion salt, saltpetre, and sugar, rubbed carefully into the ham after being thoroughly chilled and dried.

Formulæ for Curing Pork, Hams, Mess Beef, Mess Pork, &c.

Pork hams.

Temperature, 35 degrees to 40 degrees.
Pickle, 80 to 100 per cent. salt.
Saltpetre, 6 oz. per 100 lb. meat.
Sugar, 3 lb. per 100 lb. meat.
Overhaul fifth, fifteenth, and thirtieth day.
Cure seventy to 100 days.

Plate, extra mess beef, mess pork, &c.

Use pickle 100 per cent. salt.
Saltpetre, 6 oz. per 100 lb. meat.
Capping additional, 10 to 25 lb. per barrel.
Overhaul five days, and every twenty-five or thirty days thereafter.

Dry-salt cure—sides, shoulders, backs, &c.

Rub in dry salt, sprinkle lightly saltpetre.
Overhaul fifth and twentieth day.
Cure forty to sixty days, according to size.

Meats for potted ham.

Pickle, 80 per cent.
Saltpetre, ¾ oz. per 100 lb. meat.

A process similar to many others received by the Department is as follows :—

25 lb. of salt, 5 lb. granulated sugar, ¾ lb. nitrate of potash. This quantity is used for 300 lb. of hams.

The products are overhauled three or four times, and remain in pickle, according to size, viz. :—10-lb. ham, forty days ; 15-lb. ham, sixty days ; 20-lb. ham, seventy-two days. All other products are treated in like manner.

Another process is as follows :—

The hogs hang in chill-room for three days before being cut up. The hams are then put in pickle of 70 per cent. in winter and 76 per cent. in summer. To every 300 lb. of hams are added ¾ lb. of saltpetre, and 4 lb. of sugar. They are allowed to stay in this from sixty to ninety days, according to size, and are then washed, hung in the smoke-house for twenty-four hours, and are ready for market.

Another formula :—

The best fine salt, 21 lb. ; saltpetre, 8 oz. ; sugar, 5 lb. to 290 lb. of green hams ; mild cure.

Meat should be properly cooled and handled, say, three, five, and ten days, and remain in pickle sixty days. This depends on the size of the ham or piece.

The Influence of Bees on Crops.

(Continued from page 736.)

ALBERT GALE.

In some of our most ornamental plants the flowers are so inconspicuous that were it not for their foliage they would be treated as weeds and rooted out. Their brilliant foliage is their only recommendation. The carpet beds in our Botanical Gardens during summer are one of the chief attractions to the grounds. They are nothing but leaves. There is no denying their brilliancy. Watch as long as your patience will permit, you will never see pollen or honey-feeding insects alight thereon for the purpose of obtaining food. If the clipping or trimming of these carpet beds be neglected, and the tiny flowers be permitted to expand, you will at once see bees and other insects alighting for grains of pollen and sips of honey.

The caladium and the coleus have foliage far more showy than the flowers of scores of plants that are constantly visited by bees, but bright as this foliage may be, the bees are not attracted thereby. When the coleus throws up its spike of pale blue flowers then it becomes attractive to insects, and they are drawn to it, not by the colour of the flower or the leaf, but by the food contained in the former.

Again, at this season of the year (September) the peach-trees are in full bloom, so are the bougainvilleas. The brilliant crimson bracts of the latter, with their small creamy white flowers, are equally as attractive in colour as the peach-trees, yet where one bee visits the latter a thousand will visit the former.

The manufacturing of artificial flowers has become so perfect of late, and the imitations are so much like natural flowers that when placed amongst natural foliage, the experienced eye of the florist frequently fails to detect the fraud. Even if it be a honey or pollen bearing imitation *bees* are not deceived thereby. If the colour of the flowers or their forms are the advertisements telling them where they could get honey, how is it that bees and other insects are not swarming on the head-dresses of the fashionably attired ladies of to-day? No one can deny that these artificial flowers are as perfect both in form and colour to the sight as the natural ones they are meant to represent, only their essentials of reproduction are absent. The food bees require is wanting, and food, and food alone, is the only advertisement that will induce the bee to search for sustenance even in natural blooms. Their natural intelligence and generations of education have taught them the true sources of wealth. Bees will no more search colours in the expectation of getting food than a gold-miner would go fossicking in a coal-pit for gold.

Botanists and entomologists speak of bees as one of the highest types of insects, and Grant Allen, in "The Story of the Plant," speaks of them thus:—"These higher insects . . . are the safest fertilisers because

they have legs and a proboscis exactly adapted to the work they are meant for; and they have also, as a rule, a taste for red, blue, and purple flowers, rather than for simple white or yellow ones. Hence, the blossoms that especially lay themselves out for the higher insects are almost always blue or purple."

Darwin, on "Self-fertilisation of Plants," says:—"Not only do the bright colours of flowers serve to attract insects, but dark-coloured streaks and marks are often present, which Sprengel long ago maintained serve as guides to the nectary," and "that the coloured corolla is the chief guide cannot be doubted." The native daphne (*Pittosporum undulatum*) flower has a creamy corolla hidden amongst its deep green foliage. These trees, both in the Botanic and in private gardens, were in bloom at the same time as the double-flowered peach. In the former the bees were in swarms, busily at work, and only an odd bee occasionally visited the latter, and the flowers visited were those containing a few scattered anthers from whence they could scrape together a few grains of pollen. The bright blooms of the double-flowered peach could be seen hundreds of yards away, but to discover the flowers on the pittosporum you need stand underneath the tree. There is no flower in this Colony more frequently visited by bees than the simple white or creamy yellow eucalyptus bloom. It is the bee-keeper's most important source of profit.

Again we are told that markings on certain flowers are finger-posts. "The lines or spots so often found on the petals of highly-developed flowers," says the author of "The Story of the Plant," "act as honey-guides to lead the bee or other fertilising insect direct to the nectar"; he then goes on to describe the "so-called nasturtium." "The upper pair (of petals) are broad and deep-lined with dark veins which all converge about the mouth of the spur, and so show the inquiring insect exactly where to go in search of honey. The lower three on the other hand, have no lines or markings, but possess a curious sort of fence running right across the face, intended to prevent other flying insects from alighting and rifling the flower without fertilising it." The nasturtium is bi-sexual (one of those whose stamens develop before the pistil), which is said to be the reason the nectary is situated so far down the spur. In most bi-sexual flowers, in those where the stamens are first to develop, and also in those where the pistil first comes to maturity, the nectary is *not* situated low down, and as far as we know bees find no difficulty in fertilising them. Such flowers, *i.e.*, those whose nectaries are easily accessible, however, produce plenty of seed. How bees must be baffled when they visit unicolor flowers?

What a waste of time it must be for insects to discover the nectary where nature has been so remiss as not to put up guide posts. In the wild nasturtium of India the two upper petals have these "guide posts," but the three lower ones have not. The cultivated descendants of these have altered wonderfully in their shades of colours and markings. Now before me, I have some blooms that are like the originals, only the three lower petals have markings. The markings on the two upper ones are brick-colour, and in form like the broad-arrow, the apex pointing towards the nectary. The marking on the lower petals are somewhat similar only the apex points outwards. In blooms of such characters are bees much perplexed to discover the nectary? I have also before me a nasturtium unicolour, a pale sulphur-yellow, yet when in the garden I saw the bees were never at a loss which way to turn to find the nectary, and this flower was visited as regularly as those of brighter colours, and most pronounced markings. George Massee in "The Plant World," says "that the only use of colour in the flower is that

of an advertisement indicating their presence to insects." When stamens lose their character as such, and become petals, the intensity of colour increases and it becomes more attractive to the eye; nevertheless, the more double a flower becomes the less it is attractive to insects.

Mr. R. T. Baker, Assistant Curator, Technological Museum, informs me that when botanising in the mountainous districts of New South Wales, near a garden filled with gorgeous-coloured flowers, he observed a specimen of *Panax sambucifolius*, the small, inconspicuous flowers of which were literally swarming with bees in quest of honey and pollen ; and those brightly-coloured blooms in the garden were in nearly every case passed over by the bees for the purpose of visiting the specimen named.

(*To be continued.*)

Bee Calendar.

ALBERT GALE.

DECEMBER.

WE are now entering upon the most profitable season of the year as regards the honey harvest. Swarming should now be over in every part of the Colony. Of course, there will still be a few swarms coming out, and these should be returned to the parent stock. Where honey-producing flora is abundant, extracting can be carried on almost to any extent for the next six or eight weeks; even the frames in the brood chamber, where there is only a little sealed brood, may be taken with perfect safety. The two outer frames, *i.e.*, one on either side, have seldom brood on both sides; therefore, they can be put into the extractor and returned. It is only when there is plenty of honey coming in that it pays to extract from the brood chamber.

In uncapping, cut downwards, and hold the frame so that the cappings may fall clear of the comb; by so doing it will save a lot of time, and time is money. Be careful in placing the uncapped comb in the extractor. The frame must be placed so that the bottom bar, when the extractor is set in motion, should lead. The reason for so doing is that the cells have a dip. By cutting a piece of comb crosswise the angle of the dip will easily be seen. The centrifugal rotary motion of the machine draws the honey out of the cells. Therefore, it will be seen that if the top bar of the frames lead the cells incline in an opposite direction to the motion necessary for extraction, and the work is not done so cleanly, and the quantity of honey extracted is less than if the frame is placed in the machine as advised.

Do not extract from frames unless fully two-thirds of the cells are sealed, otherwise the honey will have a tendency to ferment, owing to its being unripe. If the honey is in any way watery when in bulk let it remain open in some warm position, secured against ants and other robbers. The evaporation will aid in its ripening, and give density.

Suppy the bees with plenty of water. A tub, with bits of cork or water-cress thrown in, and placed in easy access to the bees, is a very useful thing in an apiary. It saves time for the bees by preventing them going off to the creeks. One or two tins containing brackish water are also valuable. Bees are passionately fond of salt, as will be seen by the eager way they search the ground where the liquor from corned beef has been thrown out, pig-styes, the margins of brackish creeks, &c.

Supersede all useless and degenerating queens.

Orchard Notes for December.

GEO. WATERS,
Orchard Manager, Hawkesbury Agricultural College.

DURING this month the grower of summer fruits will be getting some returns. The early part of the month will see most of China Peach and its hybrids done, and Briggs' Red May and its type, such as Amsden, or June, Downing, Saunders, Waterloo, Wilder, and Gov. Garland. The foregoing varieties would be very difficult to pick out if all were put into one case—in fact, it would be almost impossible. All are nearly identical with Briggs' May, though I think from my experience with them that Downing, Waterloo, and Gov. Garland, especially the latter, are improvements on the old variety. The other varieties would not be missed if out of cultivation, as they have the bad habit of ripening on one side only, leaving the other hard and insipid.

While speaking of peaches I would like to see some growers on the Northern rivers trying some of the improvements on the old China Peach. The Sydney market would absorb good quantities of these in the latter part of November and early in this month. Most of them are the results of crosses with the Flat China and the Chinese Cling, and are good dessert varieties. The best of them are Albert Sidney, Berckman's Free, Bidwell's Early, General Lee, Improved Flat China, Remlet, Stonewall Jackson, and Tong-pa. All are good-sized varieties, and I think would amply repay planting in the locality mentioned. I would not advise planting around Sydney largely, for though they ripen very early in the northern parts, yet around Sydney, in addition to being rather subject, like the parent, to peach-curl, they do not ripen much, if any, earlier than our present varieties.

A few years ago many worthless varieties of the Japanese plums were imported into our Colony, and were bought through ignorance, as anything in the shape of a Japanese plum was taken for granted to be good. There are a few really excellent varieties, and anyone having the inferior varieties should make preparation for budding them over with a good variety. Some of the very best are the following:—Burbank, Satsuma Blood, (a round-fruited variety with red skin and flesh), Cyca Somomo or Sinkwa Momo, a heart-shaped variety similar in appearance to the preceding, Botan, Kelsey, and among newer ones, Wickson, October Purple, and Giant Jap. The two blood varieties are excellent croppers, and in addition to being good dessert, make splendid jam and bottle well.

I do not mean that the budding should be done this month, but a reminder will enable one to look about for some reliable source to obtain them, February being about the best month for the operation.

The same remarks apply to many of the worthless varieties of apricots that are being grown. These make a good stock for Japan plums also, if other varieties of apricots should not be desired.

During the month every attention should be given to the bands on apples or pears for the Codlin Moth grubs, and, as before advised, destroy all fallen fruit. One cannot expect to kill all the young grubs by spraying, so I consider a careful examination of the bands as a very necessary auxiliary.

Where pests of oranges are prevalent—either insect or fungus—every opportunity should be availed of to spray them. Do not apply while hot, dry winds are blowing. On the long days now, very early in the morning or very late in afternoon is the only time to do it, unless we have some cloudy days.

From many sources I hear of the spread of the Cottony Cushion scale among citrus trees, a scale-pest that should be watched carefully. The kerosene emulsion is the very best to exterminate this pest.

Any grower who should find among his trees any pest that he is not acquainted with should send it along to the Entomologist for identification, as nearly every pest is easily destroyed if taken in time.

In citrus-tree orchards if any good material for mulching is available, such as bush scrapings, compost heaps, rotten straw, or stable manure, it should be applied as soon as possible, as it keeps the roots cool, and tends to conserve the moisture.

As advised last month, use the cultivator at every chance, especially in the dry, warm parts of the Colony.

Any nursery stocks should be trimmed up ready for budding later on, cutting away all suckers and side shoots to a height of (say) 6 inches from the ground. Examine all grafts, especially on old trees; protect from strong winds by tying to stake as advised last month. All young nursery stock should be staked where in exposed places.

Anyone having some spare cherries they could be made into jam or made into a cherry pickle in the following manner:—

12 lb. cherries,
6 lb. sugar,
$\frac{3}{4}$ pint vinegar,
2 oz. of cloves (tied in a piece of cloth).

Put all ingredients into preserving-pan, allow them to stand until sugar quite dissolves, then slowly boil until cherries wrinkle; lift out cloves, and bottle. The above will be found to be an excellent preserve.

Practical Vegetable and Flower Growing.

Directions for the Month of December.

Vegetables.

It is not improbable that the weather will be dry and hot during this month, and consequently evaporation from the soil will be very great unless some means be adopted to prevent it as much as possible. A great deal can be done by frequent cultivation, or by the spreading of a heavy mulch all over the ground and amongst the vegetables, or most kinds of vegetables. If water is available in sufficient quantity there should be no difficulty in producing enough vegetables for the table. Irrigation on a small scale is frequently adopted where residences are situated near permanent rivers or creeks, and the results with vegetables, flowers, and fruits are highly satisfactory. Some of the appliances are extremely simple and effective, and are worked by single-horse power.

When sowing seed of cabbage, cauliflower, and other vegetables which are transplanted from seed-beds, do not sow too much at a time in order to save the trouble of making several sowings. The plants in the seed-beds deteriorate and become unfit for transplanting, and are not so likely to become such good plants as those which are young and well-grown.

Beans—French or Kidney.—It is quite possible that continual dry weather has killed off some, if not the whole, of the French beans. They need a good deal of water to keep them alive and in bearing when there has been no rain for some time. Gather up all the old plants and burn, or, better still, let them rot away in the dung-heap. Where water is available for irrigation bean-plants will continue to bear for a good while if the beans are pulled before they give any indications of being ripe. Sow in good quantity in all places where the soil is moist and in good condition, for they are a useful vegetable and much appreciated by nearly everyone. The varieties are numerous of both the dwarf and running kinds, and also of the class known as "butter beans."

Broccoli.—Sow a little seed as you would the seed of cauliflower in a seed-bed, box or pot, and when the plants are strong enough set them out in a bed about 3 or 4 inches apart. Here they should grow into good strong young plants for further transplanting when they are needed. The broccoli resembles the cauliflower very much in appearance and it is somewhat difficult for anyone not used to growing both plants to distinguish the difference between them. When sown the seed bed or box should be shaded and well watered, but the shade must not be made too heavy.

Borecole or Kale.—Sow a little seed, taking care to shade and water.

Cabbage.—Sow a little seed and treat as recommended for broccoli. This plant will not succeed in the dry weather unless the soil is moist. It will make little or no growth, and unless good supplies of water can be given it is not worth while planting until later in the season, when rain may fall. It would be just as well, however, to sow the seed and have a few on hand.

Where water is plentiful, supply growing cabbages with some liquid manure from time to time.

Cauliflower.—Sow a pinch or so of seed and treat as recommended for broccoli.

Cucumber.—Some seed may be sown if more plants are required to keep up a supply of this vegetable.

Celery.—Sow a pinch or so of seed now and then, but very little at a time, to keep up a small supply only, for it is no use having a quantity of old plants on hand. Plant out a few young plants if the soil is sufficiently moist. Celery needs an abundant supply of water and very rich soil. Liquid manure will be found very advantageous, and may be applied frequently. This is a useful vegetable, and some plants should always be grown if possible. It may be used in soups or boiled as silver beet.

A few advanced plants may be earthed up, taking care when earthing up not to let the soil fall in between the leaves.

Cress and Mustard.—Sow a little seed from time to time, if water be plentiful enough to supply the plants with some frequently.

Egg-plant.—Sow seed if plants be required.

Maize, Sweet or Sugar.—Sow a few seeds in order to keep up a supply. This vegetable does not seem to "catch on" with the people in the Australian colonies the same as it does in the United States of America, where it is largely used.

Onion.—A little seed may be sown, if more onions are needed, when the soil is moist; but it is useless sowing in very dry places.

Peas.—A little seed may be sown in the coolest parts of the Colony.

Pumpkin.—If the stock of pumpkins already raised is not sufficient, sow a little seed.

Parsley.—A little seed may be sown, if this has not already been done. Parsley is a very useful plant, and no garden should be without a supply.

Radish.—Sow a few rows in well-manured ground. Give good supplies of water if the soil be dry, and also some liquid manure. The great objec should be to grow the radishes as tender as possible.

Spinach.—Sow a little seed.

Tomato.—The supply of fruit should now be abundant. Remove all decaying tomatoes that may have fallen off the plants; also pull off the plants any fruit that has the appearance of being diseased, and burn it.

Sow seed if more plants are required.

Turnip.—Sow a little seed in drills. Thin out plants when they come up.

Flowers.

The flower garden will need a good deal of attention during midsummer, whether the season be dry or moist. If dry, and if hot winds should be of frequent occurrence, and the water supply be low, it may be difficult to keep many of the plants alive even. However, a heavy mulch will be found of great use, if it can be kept on the ground, for not infrequently strong winds will sweep a mulch clean away from gardens which have little or no protection. Shelter of some kind is of very great importance to a garden or orchard, and those who may read these directions are strongly advised to use the greatest caution and consideration before destroying any natural vegetation which may be growing in the vicinity of their homes. It is surprising how effective even a low belt of trees or shrubs may be against a heavy wind.

Roses which ceased flowering for a time may be pruned hard back and a new crop of blooms will appear before very long—give the plants a good

supply of liquid manure made from the dung of farm animals. The plants should be very heavily mulched during the whole of the summer. This mulch can afterwards be forked in after the winter or spring pruning.

Chrysanthemums will need a good deal of attention when they are being cultivated for show blooms. They will require good supplies of water and a little weak liquid manure—not too much at present, but later on it must be applied more plentifully. Remove all suckers which sprout up from round the bases of the plants. Look out for caterpillars and other insect pests, including black aphis, and get rid of them.

Dahlias will need copious supplies of water and some liquid manure. Be careful to see that the water soaks well into the soil about the roots. Tie the plants up to stakes as they grow.

If seeds of annuals and other plants are required they should be looked after soon, or else they may soon scatter about.

December is generally a very trying time for garden plants, especially carnations and perennials. Keep them well supplied with water. Remove the seed-vessels of bouvardias as soon as the flowers drop off, and fresh blooms will soon appear.

General Notes.

Food and Bacon Producing.

Pig-feeding Experiments.

A series of pig-feeding experiments, conducted at the Old Orchard, Calne, under the auspices of the Wilts County Council, with the object of establishing the relative values of foods in the production of bacon, are reported in the English *Farmer and Stockbreeder*. Mr. E. B. Hadley reports that up to a given date three sets of experiments have been made, the first and third of which extended over seven weeks, and the second eleven weeks. The foods employed for the purpose were barleymeal, maizemeal, separated milk, and bran. The two kinds of meal were fed—(1) separately; (2) each with the addition of separated milk; (3) each with the addition of bran; so that six diets were formed with the four foods. The experiments have been made on 120 pigs, and the effects of every diet referred to have been tried twice, at different times of the year, on ten pigs at a time. It is proposed to further test the results obtained by repeating the experiments, and then to issue a more detailed report.

The dry food (barley, maize, and bran) was soaked in water in the proportion of 1 peck of the former to 5 gallons of the latter, except when milk was used, in which case milk was substituted for half the water. The greater part of the milk used in the first set of experiments was fed sour, but in the third set sweet milk only was employed. The pigs were fed three times a day, and received as much as they could clear up at every meal. In every stye experiments were commenced with ten pigs, but in two cases one pig had to be killed, and then the results were determined with the remaining nine.

Results.

The tabulated returns show the following results:—A larger proportion of best pigs for bacon was obtained with barley than with maize feeding; the addition of either milk or bran, but especially the latter, to barley or maize, raised the proportion of best pigs. The weekly gain in live weight was greater from barley than from maize. The addition of milk to either barley or maize increased the weekly gain, whilst the addition of bran decreased it. On killing or dressing, maize-fed pigs lost less weight than barley-fed pigs; the addition of milk to either barley or maize appeared to cause the pigs to lose slightly less on killing; the addition of bran to the food caused a much greater loss on killing. To produce 100 lb. increase live weight about 5 per cent. more maize than barley was required; when fed with barley, 63·4 gallons of milk replaced 127 lb. of barley, or 1 gallon of milk equals 2 lb. of barley; when fed with maize, 61·4 gallons of milk replaced 185·4 lb. of maize, or 1 gallon of milk equals 3 lb. maize; fresh milk gave a much better result than stale milk; when bran was fed with

barley, 142·4 lb. of bran replaced 185·4 lb. of barley, or 10 lb. equals 13 lb. of barley; when bran was fed with maize, 155·8 lb. of bran replaced 181·3 lb. of maize, or 5 lb. of bran equals 6 lb. of maize.

Taking the price of pigs for bacon according to Messrs. Harris' scale, and the price of food—as barley, £5 per ton; maize, £4 10s. per ton; bran, £4 per ton; and milk, 1d. per gallon—the average profit per pig, calculated on the results of the three series of experiments, would be as follows:—Maize and milk, 6s. 3d.; maize and bran, 6s. 0½d.; barley and bran, 4s. 2d.; barley and milk, 3s. 7½d.; barley, 1s. 2d.; maize, 11d. Had the price of both barley and maize been £4 10s. per ton, and all other prices as given above, the average profit per pig would have been maize and milk, 6s. 3d.; maize and bran, 6s. 0½d.; barley and milk, 5s. 0½d.; barley and bran, 4s. 8d.; barley, 4s. 0½d.; maize, 11d.

Messrs. Harris & Co., in reporting upon the pigs, point out that the maize-fed pigs do not produce bacon of the first quality, and consequently only command a lower price.—*New Zealand Farmer.*

Stack-making.

There is much waste both of hay and grain every year through lack of ability to make good stacks. Undoubtedly the ease with which in all timbered districts lumber could be had for constructing barns has disinclined farmers to making stacks. Yet even where barns are plentiful, as the use of mineral fertilisers makes grain-growing easier, there is found a necessity for making stacks, both for the grain and afterwards for the straw. It is necessary to make a stack that will stand heavy storms, that it shall settle evenly, but always keep the centre highest and evenly sloping to the sides. This is done by always keeping the centre full and treading it down as compactly as possible. In threshing with steam power as many men are needed on the stack to properly care for the straw as are needed to get grain and straw to the machine. There will be less weight for the straw-handlers to move, but it will be loose, and require more forkfuls. Care should be taken to distribute the chaff evenly. It will compact and heat if left in a heap, while if scattered through the stack it will greatly add to the value of the straw for feeding purposes, besides making all the straw keep in better condition.—*American Cultivator.*

The Compost Heap.

There seems to be a tendency on the part of some otherwise progressive agricultural writers to underrate the value of the compost heap and its importance to the average farm, and to magnify the amount of labour necessarily incurred in the making of same. It is advised "to haul out the manure as fast as made," in order to save the labour incident to handling such bulky, weighty material two or more times. Since the curse was laid upon Adam in the Garden of Eden, matters in this mundane sphere have been so arranged that there shall be "no gains without pains." We, too, believe in minimising labour as much as possible consistent with performing every operation of the farm in the best possible manner, but we are willing and even glad to be able to put in lots of time and lots of labour on the making of a really good compost heap. We are proud of it while building it and after it is built—proud as were the ancient Egyptians of their "pyramids," the Rhodians of their "colossus," or the Goulds or Vanderbilts of their rich, red gold.

"Manure is the farmer's bank," and by the aid of the "compost heap" deposits are made annually that otherwise might never have been made. The very fact that a man is the owner of a store of plant food in the shape of a compost heap tends to incite him to do better farming than he has ever done before; it gives him renewed energy and determination to excel; there is something as tangible and real about a well-made and properly-proportioned compost heap as there is in a roll of greenbacks. There should be at least two compost heaps on every farm—one to put the barn-yard and stable manure, the wood ashes and phosphate and potash in, ready for use at an early date, the other to be composed of stalks, stems, vines, leaves, straw, and, in short, any and all organic matter that needs the action of time to aid the disintegrating process. Instead of decrying the compost heap and characterising it as "obsolete," "antiquated," and "a relic of old fogeyism," let us by all means multiply them until peace and plenty shall reign supreme all over this broad land. Let us realise the fact that, where the manure pile gives out, agricultural chemicals come in. Plants must be fed, and that liberally, if hearty, healthy, robust, and vigorous specimens are desired; and when the fact is borne in mind that each and every plant throughout the entire field can be made all that could reasonably be desired in this direction by simply feeding them liberally yet judiciously, giving them good distance, and cultivating them well, it does seem like such a common-sense and easily practicable system would be far more universally practised than it is. True economy does not call for a decreased amount of labour—on the contrary, it demands "the best work possible, the most of it possible, at the least cost possible."—G. H. Turner, in *Southern Farmer*.

Poultry-house Whitewash.

A capital whitewash is made by mixing common water-lime cement with sweet, skimmed milk to the proper consistency. The following is the Government whitewash, and a fine whitewash it is:—Put two pailfuls of boiling water in a barrel; add half a bushel of well-burned, fresh quicklime; put in quickly one peck of common salt, dissolved in hot water, and cover the barrel tightly to keep in the steam while the lime is slaking; when the violent ebullition is over, stir till well mixed together, and, if necessary, add more boiling water, so as to have the mass like thick cream; strain through a sieve of coarse cloth. Make a thin starch of 3 lb. of rice flour and 1 lb. of strong glue, having first soaked the glue in cold water, and to the latter mixture add 2 lb. of whiting. Add this to the limewash, and also sufficient hot water to dilute to the proper consistency; keep hot while applying. It will require about 6 quarts of the mixture to 100 square feet of surface, and it will last remarkably well. It goes without saying that it may be made any colour desired.—*Poultry Keeper*.

Turpentine as White-ant-resisting Timber.

Mr. James Waters, of Yarramalong, writes:—

"I beg to draw attention to turpentine as a white-ant-resisting timber. I have been working amongst our colonial timbers for over thirty-five years, and if I do not know the quality of them I ought in that time. I have often found white ants in the pith of turpentine, and in places where the timber was attacked by dry rot, or what we term cancers; but I have never found holes eaten through the redwood from the centre to the sap, the same as I

have seen in most other woods, nor have I ever found a white-ant between the heart and sap of turpentine. I have frequently found the ruins of small colonies in its heart, where white-ants have lived for a time and then died out or forsaken the place, as something there did not agree with them probably. I think the reason that white-ants do not attack the red or dark wood of turpentine is this: I find in sawing turpentine the saw has to be sharpened quite as often again as even in the case of ironbark. I attribute this to the large quantity of silica in this part of the wood, and the same is the cause of its white-ant-resisting property, as it wears out the teeth of the insect, whose mandibles are not strong enough to cut with blunt tools."

Influence of the Moon on Vegetation, &c.

Mr. S. Pegum, of Brownlow Hill, Camden, sends the following letter:—

"The reply of the Government Astronomer to the query *re* 'influence of the moon on vegetation, &c.,' is the usual explanation offered for the belief which is so common among farmers and country folk generally regarding the all-potent influence of the moon on their every day operations. He says it is unscientific, and regards it as the thraldom of an ancient superstition still dominating multitudes of the human race educated and uneducated.

"Now, while agreeing with Mr. Russell that the belief is unscientific and altogether erroneous, I think it can be shown that there is some seemingly apparent reason for it—that it is not altogether a superstition at least as far as Australians are concerned, who, as a people, are comparatively free from that old-world mental debasement. It must be admitted, however, that the belief prevails, and is even gaining ground of late years, but more, I believe, as the result of confused reasoning than superstition, and, like all such, will be found more tractable to argument than censure. For instance, many regard the periods of the different quarters of the moon as so many crises in the moon's condition when the circumstances and surroundings are altogether different from those immediately preceding or succeeding the event, and consequently look with confidence for some new and marked developments at the precise time. But that is not a superstition. Others, again, awaie of the effect of sunlight on vegetation, &c., exaggerate the influence of the feeble, borrowed rays of the moon, and theorise accordingly, drawing vastly exaggerated inferences and adding others crude and silly; but they cannot be called superstititious. Others, again, generally men engaged about cattle and horses, very sensible and observant men too, nowise prone to superstition, hold that when the nights are moonlight it is inadvisable to castrate, &c. This caution is not altogether groundless, and is not by any means a superstition. But the mistake is made of regarding the moon on such occasions as an agent instead of an indicator of unfavourable conditions. For a little investigation will show, from the mere fact that when the moon is shining bright in all her glory, patent and visible, the time is then favourable for other agencies which are there, and then operating with accelerated energy, but not being visible their influence is not assessed. The fact is that certain atmospheric conditions favourable to radiation, which, when sudden and excessive, may very much retard vegetation in the early tender stage, or prove inimical (inducing chills, &c.) to animals suffering from the recent shock and nervous prostration of 'cutting,' are concomitant with very bright moonlight nights, especially in certain districts of the Australian tableland, where frosty nights sometimes follow scorching summer days. (These conditions, of course, may exist when there is no

moonlight). But to show how 'the malignant influence of the moon' keeps its place in the mind, let it be remembered that the conditions above referred to, viz., cloudless sky, clear, thin air devoid of humidity, &c., not only accelerate radiation, but give full scope to the refulgent moon to beam out with all its brightness, electric and magnetic influence and energy being also at the same time fully discharged with the radiating heat, and the constitution of both plant and animal life to a certain extent tested. But of these the moon only is patent to the senses, and is vividly impressed and associated in the mind with the success or otherwise of the undertaking, while the process of radiation, though at such seasons, during the nights and evenings in full swing, depleting both plants and animals and the very earth itself, and all things unprotected, by some non-conducting material, not only of the vital energy of heat, but of electric and other subtle energies, being invisible, is not recognised at all, nor in any way regarded as a factor in the issue.

"Unfavourable results must needs be accounted for. A scapegoat is wanted. The mind reviews the time and circumstances, and, according to enlightenment, draws its conclusion. Experience seems to verify that conclusion. Then the 'wrong sow is taken by the ear,' and to the 'malignant influence of the moon' is attributed what is really due to other causes. Thus the idea becomes fixed in the mind, not, in Australia, as a superstition, but as a fact seemingly verified by experience. The idea then being established that the moon is actually unfavourable at certain times, the next step is to formulate some theory or programme, so that the moon may be favourable to operations so projected, and that some men should sow their crops, kill their beef, &c., &c., according to the moon is what may be expected. For to enlarge, exaggerate, and systematise from shadowy data, and finally add potency to potentiality, is but that phase of humanity that prompts one man to proclaim the wondrous power of his pills, and induces others to pay for them, and swallow them with eager and unreasoning alacrity. But belief in quackery, though costing the country annually thousands and thousands of pounds and much apparent energy, is never regarded as superstition."

On the same subject, J.N., of Oberon, writes:—

"In reply to Mr. J. Morrison in the June *Gazette*, I may state that no one can prove the farmer wrong who watches the moon in connection with many agricultural and other industries, and those who ridicule the matter speak in utter ignorance of the psychic effects of the solar system and the stellary universe upon the earth, or they innocently repeat the mistakes made by others without attempting to verify the assertions.

"The psychic influence of the moon upon vegetation, both in favour of it and otherwise, will astonish any person who will carefully experiment. To the farmer, theory, when put forth by others, has little effect; therefore, in the interests of the agriculturist, horticulturist, and fruit-grower, I will give some items which, if put into practice, will convince all those who wish to get at the truth of this matter.

"As a general and broad rule, upon which anyone can act, seed-sowing, tree-planting, and transplanting should be done between the new and the full moon. The destruction of weeds, ringbarking, &c., should be done in the wane of the moon. But it is not altogether the age of the moon or her relative position to the sun which has the effect; her position in the zodiac increases her power immensely. The zodiac is divided into twelve equal divisions, and these divisions have names which are familiar to many. The

ancients who watched nature closely, and the moderns who do the same, with the assistance of the experience gained by the wise men of old, find that when the moon is in certain signs of the zodiac she benefits vegetation, and when in others she retards and helps to destroy. I would recommend Mr. J. Morrison and others to test the matter for themselves. In a matter like this, where the result is so easily gathered, and the ultimate issue so momentous as between a good crop and a poor one, let them take a box or pots, and put in soil well mixed, to be of equal quality throughout, and on any of the days considered to be favourable, sow half of the box with any seed suitable to the season and climate; then on the days regarded as unfavourable, plant the other half with like seed and conditions; and for fear of accident, which may spoil the experiment, let another box be similarly prepared, and the result carefully noted. It is better to use boxes than the field, because it is almost impossible to get two plots of land alike in all particulars."

Danish Condensed Milk.

It has for a long time been the aim of scientific effort to produce condensed milk which, in taste, smell, nutritive value, and easy digestibility, would replace fresh milk, and the difficulties which have hitherto prevented the achievement of this result are now stated to have been surmounted by a process discovered by a Danish expert connected with the treatment of milk. By a very simple and ingenious method, the milk is condensed at a low temperature in such a manner that its chemical composition is not altered, and at the same time all bacteria are destroyed. The cows yielding the milk used in the factory are subjected to constant inspection of veterinary surgeons to guard against the transfer of any contagious diseases, of which milk may often be the bearer. Condensed to about one-third of the original volume, it may, in this state, serve the purpose of ordinary cream, and mixed with two parts of water to one of condensed milk, replace the original pure milk. The principal object is, however, to provide an article of export (packed in hermetically-closed tins, to secure durability for an indefinite length of time) and for use in tropical climates, where there is no opportunity of obtaining fresh milk. The milk, after passing through the condensing-vats, is tapped by the method patented by the factory into sterilised tins, which are closed air-tight as they run full, one by one, and then soldered down immediately. These tins are then placed in rows on shelves, where they remain for some time under close observation, until they are packed for exportation in cases containing four dozen each. The tins are fitted with tubes, the cutting of which enables the milk to be drawn in a clean and convenient manner. After a portion of the milk has been taken out, the tubes prevent the exposure of the milk to the air, and by this means the product retains its freshness and purity for a long period.—Foreign Office Report, No. 1,920, *Journal of the Board of Agriculture.*

Replies to Correspondents.

Comparative Values of Dairy Fodders.

MESSRS. HAYWOOD BROS., of Oaklands, Pambula, ask:—"What is the value for dairy cows of ensilage made—(1) from Planter's Friend; (2) from maize?"

This matter was discussed at the recent Agricultural and Dairy Conferences (*vide* Report, Agricultural Conference, page 34). Mr. Guthrie is of opinion that there would probably be little, if any, difference in composition between ensilage from maize and from Planter's Friend. He would make analyses if the necessary samples were forwarded.

The same correspondents also ask:—"What is the value of oilcake (manufactured in Sydney from cocoanuts), at 5s. per cwt., compared with maize at 2s. per bushel?"

Mr. Guthrie reports:—Maize fodder contains about eight times the amount of water that cocoanut-cake does. If maize grain is intended, the best way to illustrate the comparative value is to give analyses of both, viz.:—

	Maize.	Cocoanut-cake.
Moisture	11·0	8·0
Oil	5·5	19·0
Albuminoids	10·5	17·0
Carbohydrates...	69·5	40·0
Fibre	2·0	10·0
Ash	1·5	5·5
	100·	100·

Irrigating Small Areas.

MR. RODERICK H. DEMPSTER, of Longreach, Marulan, asks:—"What is considered the most efficient manner of irrigating a small farm of about 15 acres, chiefly under garden stuff; the ground almost level. Also approximate quantity of water that should be conserved for the purpose?"

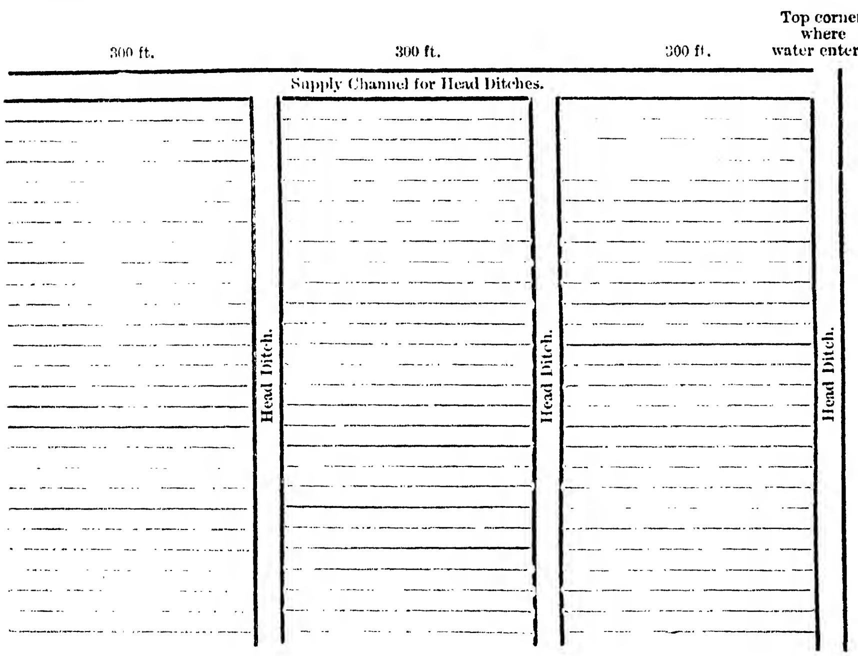
In reply, Mr. Allen states: "For irrigating a piece of land which is chiefly used for garden stuff, I would recommend that the head ditches should be about 300 feet apart, in order that the water would only have to make a short run, which is preferable in gardening. The water should come in on the highest corner of the block, and run into an open channel sufficiently large to carry the supply of water available, say, about 2 feet 6 inches wide on the top, 1 foot wide in the bottom, and a foot deep. The rows of vegetables should be at least 3 feet apart, so that a horse could walk between them, and when water is required a furrow can be drawn with a small plough. The furrows should be about 3 inches deep, and the water from the head ditch supplied to each furrow by cutting small holes in the bank of the channel, or, better, by inserting sluice-boxes or pipes at distances of every 6 feet in the bank. Through these holes or boxes the water will trickle, and

it will be found that in any loamy soil, if the furrows are kept full for six hours, the land will receive a sufficiently good soaking. Some soils may not require longer than four hours; but in any case do not allow the water to remain in the furrows longer than is necessary, and as soon as dry stir up the furrows with a single cultivator.

"There are three things to be borne in mind in irrigating, viz., avoid flooding the land—that is, always keep the water in the furrows, and cultivate thoroughly after every irrigation. Do not irrigate oftener than is really necessary, as the use of too much water is injurious to the soil.

"If the soil is porous it would require for each irrigation of the 15 acres the equivalent of 2 inches of rain, or 690,000 gallons (Imperial).

"The accompanying is a rough sketch of the way I would recommend laying out and running the water—the light lines being the rows and the direction in which the water would run."



The Manufacture of Cider.

Mr. A. W. Littlejohn, of Balmoral, in a communication received some time ago, remarked:—"It has more than once struck me that a good many apples might be made into cider, instead of, as frequently happens, being left to rot or to be fed to pigs."

Several other fruit-growers have expressed a desire for information about cider-making on a small scale, and in response to these inquiries Mr. Allen has furnished the following notes:—

"The manufacture of cider is an industry well worth the most careful attention of the fruit-grower, especially in cool and also in isolated districts where the expense of marketing the fresh fruit is so great that it leaves the grower very little profit. The want of suitable varieties of apples, I have no doubt, has to some extent deterred many from trying it, as I am satisfied

that most of those who remember their English homes have distinct and pleasant recollections of cider-making time. In its unadulterated state there can be no more wholesome and refreshing beverage, and were the fruit-growers generally to use their surplus apples in the manufacture of cider, not only for the home consumption but for the local markets, the demand for tea would soon diminish, and the lives of the consumers be prolonged accordingly.

"The very best quality, of course, can only be made from the selected apples grown for the purpose, and when thoroughly ripe; but as many fruit-growers have only a few to handle, and these not of the best, but too good to be left to rot or fed to pigs, I give the following method, which is that adopted by many of the small farmers in Canada, and I have never yet heard anyone who had cause to complain of the quality:—All windfalls and culls are gathered and allowed to remain in a cool, dry, place until such a quantity be got together as will be worth the owner's while to begin operating upon. All decayed or bruised fruit is first picked out, when the apples are put through the crusher, and ground into a pulp. This pulp should now remain in the vat for about forty-eight hours, or even longer if the weather is cool, to heighten the colour and increase the saccharine principle. It is then put into a lever press, with some clean straw at top and bottom, and gradually pressed by putting a weight on the handle, the liquid being strained either through hair-cloth or sieves into perfectly clean, sweet, sound casks. The casks, with the bung out, are next placed in a cool cellar or in a sheltered place in the open air, and fermentation commences. As the pomace and froth work out of the bung-hole the casks should be filled up with cider of the same age every day, some of which should be kept in a separate cask for the purpose. In two or three weeks the rising will cease, when the first fermentation is over, and the bung may be put in loosely; then, in a day or two, driven in tight, leaving a small vent-hole near it, which may also be stopped a few days after. If the casks are in a cool place the fermentation will cease in a day or two, and this state may be known by the liquid becoming clear and bright. The cider can then be drawn off into a clean cask.

"The cost of a small cider mill, which can be run by hand with a lever press, is merely nominal. I have seen many in Canada which did not exceed £5, and with this, and the vats once purchased, the fruit-grower will soon be repaid if he has used care in the making, as good cider will always bring a very fair price.

"I have tried to deal with the simpler way of making cider for those who only have a small quantity of fruit to use up; but for a first-class quality, and for those who desire to go into cider-making on a larger scale, I would refer to an article written by Mr. A. H. Benson in the *Agricultural Gazette* of February, 1894."

Wheat Chaff from "Stripped" Crops.

Mr. Charles Ridout, of North Barellan, *via* Narandera, writes:—

"There is a difference of opinion among the settlers here regarding the feeding value of the wheat chaff from strippers. Some think it is more profitable to cut some of the straw after the stripping is over than take the trouble to house the chaff. The question is, has the chaff been analysed, or what is its feeding value in comparison with dry straw?"

No analysis of wheat chaff has been made by the Department, and Mr. Guthrie is unable to find any analyses that have been made elsewhere of chaff. If a sample is sent in he will be glad to analyse it and report.

Converting Fruit into Pulp.

Mr. Henry Wilson, of Wiseman's Ferry, asks for information as to the method of converting fruit into pulp, and preparing the product for market.

The Fruit Expert, Mr. W. J. Allen, reports:—

"The following is the method of pulping fruit in Mildura, where apricots and peaches are the principal fruits used, viz.:—

"The fruit is first pitted and put into a copper or cauldron, and a little water added (proportion—1 gallon of water to 3 cwt. of fruit). It is then boiled for twenty minutes (*i.e.*, twenty minutes from the time it starts boiling). Unripe fruit will require a little longer, and should the fruit be watery it can be cooked without adding water. When first put in it is stirred constantly to keep it from burning. After cooking it is put into tins, and tins soldered whilst hot.

"Occasionally the fruit is cooked in the tins, and when this is done the tins, after being filled and closed, are punctured and immersed in water to within, say, 2 inches of the top, or just so that the water will not boil over the top of the tin and get into the punctured hole. The fruit is cooked for twenty minutes, as explained, and the hot air is blown off through the hole. As soon as cooked the tins are sealed. Ten-pound tins are the best when the fruit is cooked in this way, as the reaction draws in and disfigures larger tins.

"The fruit done in tins is not pulped or mashed to the same extent as that which is boiled and stirred in the cauldron, and with apricots and peaches brings a better price; fruits pulped in this manner bringing all the way from £13 to £18 per ton in London."

Tobacco-dust for Snails.

A number of inquiries have been received from time to time from persons whose gardens are infested with snails.

The following communication from Mr. Hugh Dixson, of Summer Hill, may be of interest:—

"Quite recently I had a lot of tobacco-dust, which I sent to the house for manuring purposes. Most of it was spread on grass, but some of the dust was put around various plants. Amongst others were several plants, such as Flag Iris, that were very much infected by the shell snail. We found that these snails when they left the plants, and crawled over the tobacco-dust, became so sick that they were not able to get back again, and remained so exposed that they could be readily picked up or crushed with the foot where they were. I have since learned that the snails which have come into contact with the tobacco-dust dry up in their shells, and can then be readily swept up."

Destruction of Fruit and Grain-eating Birds.

Mr. Andrew Crawford, of Mount Allen, Michelago, asks for information as to the simplest means of poisoning destructive birds. He says the parrots are very troublesome in his district, and grain poisoned in the ordinary way (smeared with some poison) does not kill them, because they eat the inside of the grain only.

The Fruit Expert, Mr. W. J. Allen, reports:—

"In California we destroyed linnets and other troublesome birds which ate the fruit-buds off the trees in winter and early spring, by injecting a small quantity of strychnine into either apples or pears (quartered for the

purpose), and these were stuck on the ends of the twigs. The birds ate the poisoned fruit, and were killed by hundreds. I could not, however, say whether this would answer with parrots, as it is just possible they would not eat the fruit. If there were some simple method of poisoning hull-less wheat or barley, it ought to be possible to destroy a good many birds, because they would have to eat the whole grain."

Mr. Guthrie suggests that grain might be rendered poisonous with strychnine by soaking in a solution—strychnine in acetic acid or vinegar; on drying the acid would evaporate, or a paste could be made with meal and arsenic or strychnine, which could be mixed with the grain, so that the birds would have to eat some of it if they devoured the grain. This advice is only suggestive. Parrots are very difficult birds to poison. The old gun seems to be the only remedy short of parrot-proof netting.

The Feeding Value of the Jerusalem Artichoke.

Mr. W. Forster Rutledge, of Gidleigh, Bungendore, asks for information as to the value of the Jerusalem Artichoke as fodder for cows and horses. He finds that it grows well, and yields a large return in his district, and that all kinds of stock eat it readily.

Mr. Geo. Valder is of opinion that, as a fodder, the tubers of the Jerusalem Artichoke are of great value, and it is generally agreed that this food will largely increase the milk-yield of cows. At the Hawkesbury Agricultural College this season Mr. Valder is planting a large quantity of this crop, with the view of carrying out systematic feeding experiments. Horses, sheep, and pigs also do well on the tubers. An article on this crop appears in the "Farmers' and Fruit-growers' Guide," page 170.

The Manufacture of Perfumes.

From correspondence received, it appears that considerable attention is being devoted to the growth of plants for perfumery purposes.

One correspondent writes:—

"I am going in for the cultivation of roses for the manufacture of perfumes, as advised by the Department of Agriculture. Will my operations come under the Distillery Act?"

The Collector of Customs, Mr. N. Lockyer, informs us that the manufacture of perfumes does come within the scope of the Distillation Act. Section 18 of the Act provides for the issue of a license for the use of a still of not more than eight (8) gallons content for the purpose of distilling scent or perfumes. The license fee is £2 per annum, and the licensee is required to enter into a bond for £200, with the usual sureties, that he will not make use of the still, or suffer it to be employed, for any purpose other than that specified. This bond requires a duty stamp of £1. All licenses terminate on the 31st December in each year. With the application for license, which is made to the Colonial Treasurer, it is necessary to forward the amount for the license fee and the stamp, together with the bond duly executed.

AGRICULTURAL SOCIETIES' SHOWS, 1897.

Society.	Secretary.	Date.
Dapto A. and H. Society	A. B. Chippendall	Jan. 6, 7
Albion Park A. and H. Association	H. Fryer	,, 13, 14
Gosford A. and H. Association	W. McIntyre	,, 29, 30
Wollongong A. and H. Society	J. A. Beatson	Feb. 3, 4
Cobargo A., P., and H. Society	T. Kennedy	,, 16, 17
Ulladulla P. and A. Society	C. A. Cork	,, 16, 17
Berrigan A. and H. Society	R. Drummond	,, 17
Riverina P. and A. Society (Cereal)	W. Elliott	,, ——
Manning R. (Taree) A. and H. Association	H. Plummer	,, 18, 19
Lithgow A., H., and P. Society	J. Asher	,, 18, 19
Robertson Agricultural Society	R. J. Ferguson	Mar. 2, 3
Bega A., P., and H. Society	J. Underhill	,, 3, 4
Southern New England (Uralla) P. and A. Association	Jas. Leece	,, 9, 10
Tumbarumba P. and A. Society	W. Willans	,, 9, 10
Tenterfield Intercolonial P., A., and M. Society	F. W. Hoskin	,, 10, 11, 12
Coonabarabran P. and A. Association	E. May-Steers	,, 11
Oberon A., H., and P. Association	A. Gale	,, 11, 12
Berrima District (Moss Vale) A., H., and I. Society	J. Yeo	,, 11, 12, 13
Cobargo A., P., and H. Society	T. Kennedy	,, 16, 17
Crookwell P. and A. Association	W. P. Levey	,, 18, 19
Lismore A. and I. Society	T. M. Hewitt	,, 18, 19
Walcha P. and A.	F. Townsend	,, 23, 24
Cudal A. and P. Society	C. Schramme	,, 24, 25
Blayney A. and P. Association	J. Clements	April 1, 2
Mudgee A., P., H., and I. Association	J. Cox	,, 6, 7
Liverpool Plains (Tamworth) P., A., & H. Association	A. M'Leod	,, 6, 7, 8
Warialda P. and A. Association	W. B. Geddes	,, 7, 8
Williams River A. and H. Association	W. Bennett	,, 7, 8
Cooma P. and A. Society	D. C. Pearson	,, 7, 8
Orange A. and P. Association	W. Tanner	,, 7, 8, 9
Gulgong P. and A. Association	C. E. Hilton	,, 13, 14
Queanbeyan P. and A. Association	W. D. Wright	,, 13, 14
Royal Agricultural Society	F. Webster	,, 14-20
Moree P. and A. Society	S. L. Cohen	,, 21, 22
Clarence P. and A. Society (Grafton)	J. Wilcox	,, 27, 28
Bathurst P. and A. Society	W. G. Thompson	,, 28, 29, 30
Hunter River (West Maitland) A. and H. Association	W. C. Quinton	,, 28, 29, 30
Hay Hortic. Society	J. Johnston	May 5
Namoi P. and A. Association (Narrabri)	J. Riddle	,, 5, 6
Hawkesbury District Agricul. Association (Richmond)	C. S. Guest	,, 6, 7, 8
Upper Manning A. and H. Society	W. Dimond	,, 12, 13
Wellington P. and A. Society	R. Porter	,, 13, 14
Upper Hunter P. and A. (Muswellbrook)	J. C. Luscombe.	,, 19, 20, 21
Nyngan and District	E. H. Prince	June 1, 2
Brewarrina P. and A. Association	H. L. Cathie	,, 7, 8
Cobar P. and A. Association	W. Redford	,, 9, 10
Deniliquin P. and A. Society	H. J. Wooldridge	July 13, 14
Hay P. and A. Association	Chas. Hidgcock.	,, 22, 23
Riverina P. and A. Society (Jerilderie)	W. Elliott	,, 27, 28
Condobolin P. and A. Association	H. W. Grey Innes.	,, 28, 29
Lachlan P. and A. Association (Hillston)	Thos. Cadell	,, 30
Gunnedah P., A., and H. Association	J. H. King	Aug. 3, 4
Forbes P., A., and H. Association	F. Street	,, 5, 6
Corowa P., A., and H. Society	E. L. Archer	,, 19, 20
Cootamundra A., P., H., and I. Association	T. Williams	,, 25, 26
Grenfell P., A., H., and I. Association	G. Cousins	,, 25, 26
Northern Agricultural Association	C. Poppenhagen	Sept. 1, 2
Murrumbidgee P. and A. Association (Wagga)	P. W. Lorimer..	,, 1, 2
Burrawong P. and A. Association (Young)	C. Wright	,, 1, 2
Manildra Agricultural Society (Ploughing Match and Horse Parade.)	G. W. Griffiths..	,, 8
Albury and Border P., A., and H. Society	Geo. E. Mackay	,, 8, 9
Murrumburrah P., A., and I. Association	Miles Murphy	,, 8, 9
Yass P. and A. Association	Thos. Bernard	,, 9, 10

Society.	Secretary.	Date.
Wallsend and Plattsburg A. H. P. P. and C. Society ...	G. Gilmour ...	Sept. 9, 10, 11
Junee P., A., and I. Association	T. C. Humphrys	,, 15, 16
Burrowa P., A., and H. Association	J. H. Clifton ...	,, 16, 17
Cowra P., A., and H. Association	Fred. King ...	,, 22, 23
Temora P., A., H., and I. Association	W. H. Tubman.	,, 22, 23
Moama A. and P. Association	C. L. Blair ...	,, 29
Narrandera P. and A. Association	J. F. Willans ...	Oct. 6, 7
Berry Agricultural Association	A. J. Colley ...	Nov. 24, 25, 26
1898.		
Dapto A. and H. Society	A. B. Chippendall	Jan. 12, 13
Albion Park A. and H. Association	H. Fryer ...	,, 19, 20
Kiama A. Association	J. Somerville ...	,, 25, 26
Gosford, A. and H. Association	W. McIntyre ...	,, 28, 29
Alstonville Agricultural Society	H. R. Elvery ...	Feb. 1, 2
Wollongong A., H., and I. Association	J. A. Beatson ...	,, 2, 3
Robertson Agricultural Society	R. G. Ferguson..	,, 8, 9
Shoalhaven A. and H. Association	R. C. Leeming...	,, 10, 11
Manning River A. and H. Association (Taree)	H. Plummer ...	,, 10, 11
Nepean District A. H. and I. Society	E. K. Waldron..	,, 10, 11
Moruya A. and P. Society...	John Jeffery ...	,, 11, 12
Ulladulla A. and H. Association (Milton)	C. A. Cork ...	,, 16, 17
Kangaroo Valley A. and H. Association...	W. Randall ...	,, 17, 18
Tumut A. and P. Association	B. Clayton ...	,, 26, 27
Southern New England P. and A. Association (Uralla)	J. D. Leece ...	Mar. 1, 2
Bega A., P., and H. Society	J. Underhill ...	,, 2, 3
Upper Hunter (Muswellbrook) P. and A. Association...	J. C. Luscombe.	,, 2, 3, 4
Tumbarumba and Upper Murray P. and A. Society ...	W. Willans ...	,, 8, 9
Lismore A. and I. Society	T. M. Hewitt ...	,, 3, 4
Bombala Exhn. Society	R. H. Cook ...	,, 8, 9, 10
Tenterfield Intercolonial P., A., and M. Society ...	F. W. Hoskin...	,, 9, 10, 11
Cudal A. and P. Society	C. Schramme ...	,, 10, 11
Crookwell P. and A. Association	M. P. Levy ...	,, 10, 11
Oberon A. H. and P. Association	Alfred Gale ...	,, 10, 11
Inverell P. and A. Association	I. McGregor ...	,, 10, 11, 12
Berrima District (Moss Vale) A. H. and I. Society ...	J. Yeo	,, 10, 11, 12
Armidale and Glen Innes Combined New England District Show at Armidale.	J. Allingham ...	,, 16, 17, 18
Cumnock P. and A. Association	Thos. Howard...	,, 17
Blayney A. and P. Association	G. Pile, junr. (acting).	,, 17, 18
Goulburn A., P., and H. Society	J. J. Roberts ...	,, 17, 18
Walcha P. and A. Association	F. Townshend...	,, 22, 23
Namoi P., A., and H. Association	J. Riddle ...	,, 23, 24
Central Richmond (Coraki)	D. Cameron ...	,, 24, 25
Camden A., H., and I. Society	W. R. Cowper...	,, 23, 24, 25
Bathurst A., H., and P. Association	W. G. Thompson	,, 23, 24, 25
Liverpool Plains P. A. and H. Association (Tamworth)	A. C. M'Leod...	,, 29, 30, 31
Cooma P. and A. Association	D. C. Pearson...	,, 30, 31
Macleay A., H., and I. Association	J. M'Maugh ...	,, 30, 31, and April 1.
Mudgee Agricultural Society	J. M. Cox ...	April 14, 15
Orange A. and P. Association	W. Tanner, junr.	,, 30, 31, April 1
Molong A. and P. Association	P. F. A. Kinna..	April 5, 6
Warialda P. and A. Association	W. B. Geddes...	,, 6, 7
Royal Agricultural Society of N.S.W.	F. Webster ...	,, 6-12
Richmond River A., H., and P. Society (Casino) ...	Jas. T. Tandy...	,, 14, 15
Moree P. and A. Society	S. L. Cohen ...	,, 27, 28
Dubbo P. A. and H.	H. Munckton ...	,, 26, 27
Hunter River (Maitland)	W. C. Quinton	,, 27, 28, 29
Gunnedah P. and A. Association	J. H. King ...	May 10, 11
Hawkesbury District Agricultural Association	C. S. Guest ...	,, ——

Secretaries of Societies are asked to forward dates of forthcoming Shows as soon as decided.

Sydney: William Applegate Gullick, Government Printer.—1897.

Neurachne alopecuroides, R. Br.

Useful Australian Plants.

BY J. H. MAIDEN,
Government Botanist and Director of the Botanic Gardens, Sydney.

No. 47.—*Neurachne alopecuroides*, R. Br.

Botanical name.—*Neurachne* from two Greek words, *neuron* a sinew or a nerve, *achne* chaff (in botany, glume), referring to the nerves on the glumes; *alopecuroides* from *Alopecurus* and *oidos*, like, denoting similarity to the genus of grasses known as *Alopecurus*.

Where figured.—*Icones plantarum*, 1241.

Botanical description (*B. Fl.* vii, 507)—

> *Stems* erect, 1 to 1½ feet high, with the nodes usually hairy, otherwise glabrous.
> *Leaves* rather short, narrow, and rigid, mostly at the base of the stem, glabrous except the dense cilia of the ligula, the upper ones few and small.
> *Spike* ovoid or oblong, ¾ to 1 inch long.
> *Spikelets* numerous, densely crowded all round the rhachis, but spreading and very readily falling away, a few at the base of the spike barren and almost reduced to single ciliate glumes, but more persistent, and forming an involucre at the base of the spike. Each spikelet about 3 lines long, with a tuft of hairs at the base.
> *Outer glume* rather shorter, five or seven nerved, tapering to a fine point with a few spreading hairs on the back; second glume many-nerved, tapering to a fine point, densely ciliate with long hairs on each side; third glume rather shorter, with few nerves, sprinkled with a few short hairs.
> *Fruiting glume and palea* thin and hyaline.

Value as a fodder.—Though coarse, it is a welcome fodder in summer, as the young leaves push out as long as there is any moisture in reach of the roots. (Tepper.)

Fungus found on this grass.—*Ustilago Tepperi*, Lud.

Habitat and range.—Found in all the colonies except Tasmania and Queensland. An interior species.

Reference to Plate.—A, The ovoid or nearly oblong spike; B, Spikelet, with tuft of hairs at the base; C, Spikelet dissected, showing outer glume (the largest); this and the second glume densely ciliate with long hairs. The third glume sprinkled with short hairs; also the fruiting glume and palea.

No. 48.—*Panicum trachyrhachis*, Benth.

Botanical name.—*Trachyrhachis*, from two Greek words, *trachys* rough or harsh, and *rhachis* the backbone (as applied to animals), the rhachis (in botany), or axis, supporting a flowering stem. In this grass the rhachis is rough, and so are the branches of the panicle.

Vernacular name.—"Oo-kin," of the aborigines of the Mitchell River, Northern Queensland.

Botanical description (*B. Fl.*, vii, 490)—

A tall, erect, stout, glabrous plant, nearly allied to *P. decompositum.*

Leaves long and narrow, the ligula reduced to a ring of cilia, the nodes glabrous.
Panicle large and loose, often 1 to 1½ feet long, with numerous long, slender, divided branches, the lower ones usually verticillate, scabrous, as well as the rhachis.
Spikelets all pedicellate, nearly 1½ lines long.
Outer glume often as long as the others, three or five nerved, tapering into a long point, sometimes ciliate at the end; second and third glumes nearly equal, acutely acuminate, seven or nine nerved, the third with a palea often nearly as long, but no stamens in any of the specimens examined.
Fruiting glume much shorter, obtuse, smooth, and shining.

Var. tenuior.—More slender, panicle not so large, and less scabrous, and the glumes less acute (the form found in this Colony).

Value as a fodder.—Though not of the first class, it affords useful fodder, and is especially valuable, because it is frequently found in arid situations.

Other uses.—"The fibre is peeled from the under surface of the leaf by breaking it in the middle across with a sudden jerk while held between the fingers, and drawing the threads away. These are twisted up at once into twine by the Cloncurry (Queensland) natives."—(E. Palmer.) The aborigines sometimes use the grain for food.

Habitat and range.—Found in this Colony, and also Queensland and Northern Australia. With us it has only been found in the north-west of the Colony, but in the other colonies in the coast districts.

Reference to Plate.—A, Portion of a panicle—note the pedicellate spikelets; B, Spikelet, showing relative size of outer glume; C, Spikelet dissected, showing outer glume, second, and third glume; D, Fruiting glume and its palea.

Panicum trachyrhachis, Benth.

Fig. 1.—100 ounces of Algerian wheat.

3·25 3·00 2·75

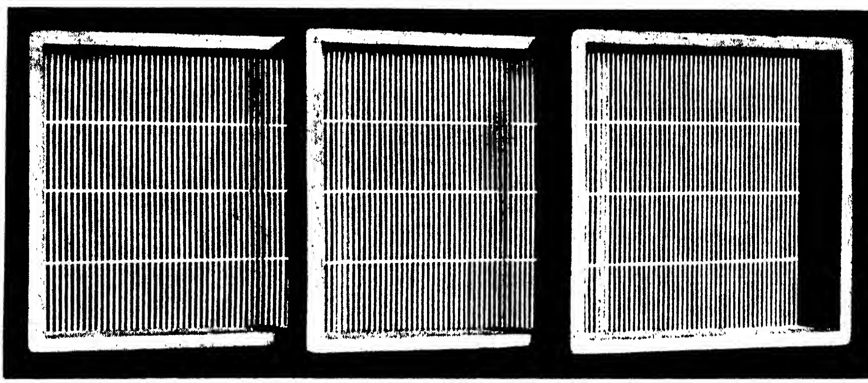


Fig. 2.—Three sieves of varying grades from 3·25 millimetres to 2·75 millimetres; about one-tenth natural size.

2·50 2·25 2·00

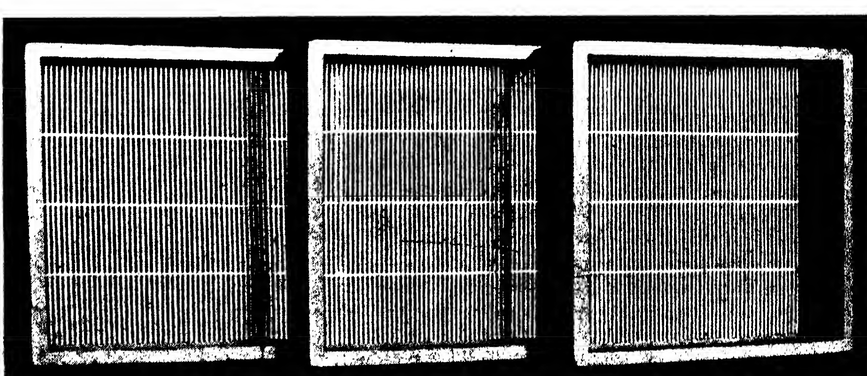


Fig. 3.—Three sieves of varying grades from 2·50 millimetres to 2·00 millimetres; about one-tenth natural size.

The Grading of Wheats.

N. A. COBB.

The grains in a given sample of wheat vary in size. If the sample be passed through a sieve, having a mesh sufficiently large to remove only the very largest grains, and then successively through sieves having smaller and smaller meshes, until no more grains will pass through, the sample will have been *graded*—that is, divided into portions, each of which contains only grains of a given size. Thus, suppose the pile of wheat, shown in Fig. 1, be passed in the manner described through the sieves, shown in Figs. 2–3, it will then be divided into seven grades, as shown in Fig. 4. The largest grains are contained in the left-hand pile (Fig. 4), and the smallest in the right-hand pile. As to the actual size of the grains in each pile, this is shown in Figs. 5–11, and is determined by the mesh of the sieves just described.

Of course, different varieties of wheat grade up differently, according as they yield a majority of large or small grains, and the differences shown in this respect are very striking. Compare, for instance, Algerian with Defiance. (*See* Figs. 4 and 12.) The difference is very marked—for while the bulk of Algerian is contained in grade 325, the bulk of Defiance is contained in considerably lower grades. Again, it is to be seen, that while the grain of Algerian is mostly of *one* size or grade, that of Defiance contains a wide assortment of sizes.

The reason for these marked differences is easy to see when once we consider attentively the arrangement of the grain in the ear.

Illustrations 13 to 14 show the arrangement of the grain in the ears of two varieties of wheat, viz., Talavera, a variety characterised by the presence in each spikelet of two large grains; and Defiance, a variety characterised by the presence in each spikelet of three or four or more grains, the uppermost of which at least are small, in accordance with a well-known law of plant growth.

It is a common supposition that the more grains there are in a spikelet the better; but whether this supposition is correct is another question. It is certainly open to question whether two well-grown grains may not be intrinsically better than three or four, part of which are ill-grown.

We may argue this *à priori*, or we may compare the analysis of large and small grains. *A priori*, it seems fair to presume, that the upper grains in a spikelet, which are by nature the last to develop, will be the last to be supplied with nourishment, and, if there is any lack of food, be the first to starve. The ultimate size of the various grains in a spikelet (the upper and last to develop are always the smaller) gives countenance to this argument. Examinations made by the author, so far as they have gone, show that the return of flour is poorer from the small grains of a variety than from the large grains; and, moreover, that the flour is of poorer quality. This result of laboratory examination is confirmed by the miller's practice of excluding small grains—that is, sieving them out.

It is evident then that any information as to the proportion of large grain produced by a given variety of wheat is useful information, more particularly to millers and growers.

With these thoughts in mind I began at the Wagga Experiment Farm four years ago to collect information concerning the manner in which the various common varieties of wheat grade up. This was done in connection with the stud plots of wheat, and as the nature of these plots may not be familiar to the reader, it will probably be best to insert here a description of them.

To make the matter clear I will describe the method adopted and successfully carried out for four years at Wagga.

To begin with, the seed for the Wagga Experiment Farm was collected during the years 1890 and 1891 from all parts of the world, and it is quite safe to say that I received along with it quite a fair share of every important wheat disease. Stud plots were started, and were located as they should be, namely, on the side of the farm or paddock towards the prevailing wind, or, if not, then at a distance from all other wheat. Unfortunately this rule has sometimes had to be abandoned, but always, I am now convinced, with disadvantage. Each stud plot, one for each principal variety, was grown from selected seed. When ripe, and during growth, the plants were inspected, and all the diseased and undesirable ones removed and destroyed. This gave a crop of improved, healthy seed. The reason the windward side of the field was preferred as a location for the stud plots was the fact that in that position fewer spores, either of smut or other diseases, would be blown on to the plants it was desired to improve by selection. They would thus be kept all the more free from disease. A few of the very best plants from each stud plot were reserved so as to secure seed for a similar stud plot next year. The remainder was used as seed wheat next year, and produced a few acres of as healthy wheat as could be obtained. The seed, being derived from healthy plants, did not need to be treated with hot water or anything else, so this expense was saved. These few acres were subjected to a less rigid inspection and again used for seed, this time producing (say) 50 acres of wheat. Meanwhile the second stud plot had furnished another half bushel or more of healthy seed, and a few extra good plants with which to start a third stud plot.

The continuance of this system, when once inaugurated, insures a constant supply of healthy seed wheat of superior quality; and of the good results of the method, I wish to give farmers the most positive assurance.

Though the carrying out of this system with such a large number of wheats as are handled at the Wagga and Bathurst Experiment Farms is somewhat expensive, the extra cost is due solely to the strict and skilled supervision that has to be exercised in order to insure accuracy in the work. With only one or two varieties on an ordinary farm the method is a very simple one, and one that should be very widely adopted.

About three years are required to get this system of producing seed wheat into good running order, after which it will give very little trouble, and pay its way ten times over every year in the superiority of the resulting crops, not only through their freedom from smut and other diseases, but in extra yield and quality of the grain.

Now the seed from the "few of the very best plants from each stud plot" had to be graded in order to secure the large plump grain, which alone is used in sowing a stud plot. It is the notes and calculations made from these various gradings that form the subject of the present article. It should therefore be remembered that the figures and illustrations are obtained from well-grown and perfectly healthy plants of each variety as grown at the

3·25 3·00 2·75 2·50 2·25 2·00 Rubbish.

Fig. 4.—100 ounces of Algerian wheat graded into seven grades, showing the bulk of the grain to be of large size. (To the same scale as Fig. 1.)

3·25 3·00 2·75 2·50 2·25 2·00 Rubbish.

Fig. 5. Fig. 6. Fig. 7. Fig. 8. Fig. 9. Fig. 10. Fig. 11.

Figures showing the size of the grains belonging to each grade yielded by the sieves shown in figures 2 and 3. The proper grade numbers are placed above each illustration.

2·00 2·25 2·50 2·75 3·00 3·25

Fig. 12.—100 ounces of Blount's Lambrigg graded into seven grades, showing the bulk of the grain to be of only medium size. (To the same scale as Fig. 1.)

Fig. 13.—An ear of Talavera wheat, with the grains arranged as extracted from one side of the ear.

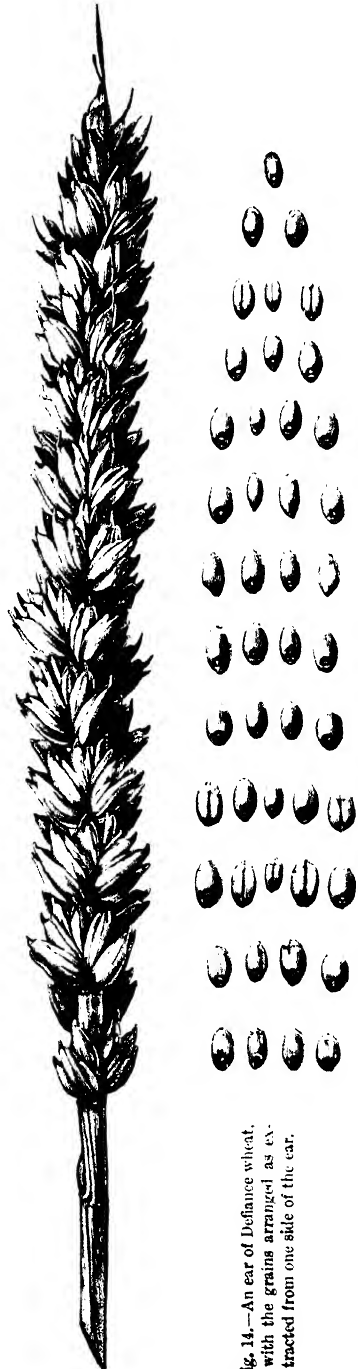


Fig. 14.—An ear of Defiance wheat, with the grains arranged as extracted from one side of the ear.

Fig. 15.—Partial view of two stud wheat-plots at the Wagga Experiment Farm. The plot on the left has been weeded out as described in the text ; so has the plot on the right. The four rows in the middle of the picture have not been weeded out. It will be noted that in some parts of the left hand plot nearly all the plants have been pulled up and removed for one reason or another. The plants left standing, having passed the inspection, are next reaped and threshed. The wheat stooked in the middle distance came from a stud plot of the year 1894 - in other words, is the second generation of seed from just such a plot as is shown in the foreground. The distant paddock, just this side of the uncleared land, is aucut wheat, also on the Experiment Farm.

Wagga Experiment Farm, and during three years. In such cases as the present it is only by obtaining the average of several years work that reliable results can be secured. The following varieties were graded:—

Talavera de Bellevue.	Allora Spring.
White Velvet.	Farmer's Friend.
Marshall's No. 3.	Zealand.
Early Para.	White Tuscan.
King's Jubilee.	Blount's Lambrigg.
Australian Talavera.	Marshall's No. 8.
Red Straw.	White Essex.
Velvet Pearl.	Golden Drop.
Canning Downs R.R.	Hudson's Early Purple Straw.
White Lammas.	Rattling Jack.
Early Baart.	Budd's Early.
White Naples.	Algerian.
Steinwedel.	

This list includes types of most of the varieties of wheat principally grown for flour, in this country. There need be no mistake about the exact nature of the samples tested, if reference be made to the descriptions published in the *Agricultural Gazette* of New South Wales, 1893, pages 431 to 471, where these varieties are as fully described as the limits of our knowledge then permitted. The results herein presented thus rest on a definite basis, because the names of the samples tested represent definite varieties in a state of purity. I have no hesitation in repeatedly calling special attention to this fact, because I am convinced that much of the work that has been done on wheat has been rendered worthless on account of the indefiniteness that existed in wheat nomenclature.

In order that the reader may get an accurate idea of the manner in which the work was carried out I will give the history of one test, namely, that on the variety known as Zealand.

A sample of this wheat was passed many times successively through a sieve of 3·25 millimetres mesh until no more grains could be caught in the meshes. This tedious process is necessary if accurate grading is to be done. The grains caught in the 3·25 mesh were set aside as 325 grade, and the remainder was passed in a similar manner through a sieve of 3·00 millimetres mesh, and so on until all the sieves down to the 2·00 millimetres mesh had been used.

The samples of each grade were weighed, and each weight divided by the total weight, so as to find the percentage by weight of each grade.

The resulting figures were as follows:—

	325	300	275	250	225	200	Rubbish.
First year	46·54	49·86	21·01	5·36	1·20	·59	·10

From year to year this variety, tested in the above way, gave figures as follows:—

ZEALAND.

	325	300	275	250	225	200	Rubbish.
First year	46·54	49·86	21·01	5·36	1·20	·59	·10
Second year	80·29	17·95	·95	·33	·05	·29	·15
Third year	63·14	31·84	4·65	·33	·02	·02	·02
	189·97	99·65	26·61	6·02	1·27	·90	·27
Average per cent.	63·33	33·22	8·87	2·01	·42	·30	·09

Although a greater number of seasons would have given more accurate results, I have concluded that further observations would not seriously disturb the relative position of any variety as it now stands in my list, and so have concluded to publish the results, which I have no doubt will be examined with interest and profit by many readers of this *Gazette*.

In order to give the results in a graphic form I asked Mr. E. M. Grosse to take 100 ounces of wheat and weigh it out in piles according to the figures for each variety given in the table of results. This has been done in his usual careful manner.

TABLE showing the percentage of Grains of various sizes yielded by different varieties of Wheat.

Name of Variety.	Percentage of Grade. 325	Percentage of Grade. 300	Percentage of Grade. 275	Percentage of Grade. 250	Percentage of Grade. 225	Percentage of Grade. 200	Percentage of Grade. Rubbish.
Algerian	81·08	14·44	3·41	·85	·08	·05	·10
White Essex...	68·33	23·57	6·46	1·34	·10	·06	·14
Tardent's Blue	66·07	25·98	6·05	1·27	·31	·14	·16
Zealand	63·33	33·22	8·87	2·01	·42	·30	·09
Marshall's No. 8	60·98	29·32	7·24	1·57	·16	·27	·61
Marshall's No. 3	59·37	30·64	6·60	2·34	·26	·40	·40
Australian Talavera	57·43	27·76	13·52	1·02	·15	·10	·03
White Lammas	58·59	27·29	12·36	1·55	·11	·05	·03
Early Baart	51·38	37·17	8·98	2·01	·279	·075	·109
Steinwedel	48·23	35·88	11·54	3·31	·53	·30	·12
Hudson's Early Purple Straw ...	48·34	38·12	7·98	4·22	·87	·50	·14
Farmer's Friend	46·96	39·63	8·01	3·79	1·09	·29	·23
White Naples	50·85	29·03	16·81	2·94	·15	·16	·9
King's Jubilee	46·73	31·11	17·90	3·78	·55	·14	·12
Venning's	41·72	38·08	14·90	4·47	·75	·08	·00
Red Straw	36·97	48·95	9·26	3·80	·56	·40	·09
Golden Drop...	34·94	46·69	13·60	3·73	·46	·45	·15
Rattling Jack	34·07	46·84	10·01	6·02	1·26	1·13	·62
Allora Spring	30·55	43·99	10·37	10·78	·45	·35	·10
Canning Downs	25·49	47·77	15·43	8·73	1·24	1·03	·33
Talavera de Bellevue	24·53	51·20	18·22	5·14	·44	·35	·14
Budd's Early	6·32	54·31	30·24	7·89	·65	·48	·13
Early Para	32·50	40·56	18·13	6·42	1·39	·77	·18
White Velvet	22·17	35·23	25·71	12·84	2·59	1·09	·27
White Tuscan	21·00	47·00	23·08	8·27	·26	·24	·10
Bearded Quartzlee	11·42	50·54	19·88	15·42	1·34	1·17	·28
Velvet Pearl...	20·18	37·74	21·56	15·72	2·30	2·20	·30
Blount's Lambrigg	5·77	33·25	28·97	25·02	3·68	2·54	·78

It has long been my hope that the different varieties of wheat might yet be distinguished from each other readily by the grain alone, and this investigation may be regarded as a further slight contribution in that direction, incident to my work in connection with wheat at the Wagga Experiment Farm.

Millers will not fail to notice that the illustrations and figures show them at once, with regard to any particular variety, how to set their rollers to crack it to best advantage, so far as size alone is concerned. This is a matter which much exercises the mind of the Australian country miller,

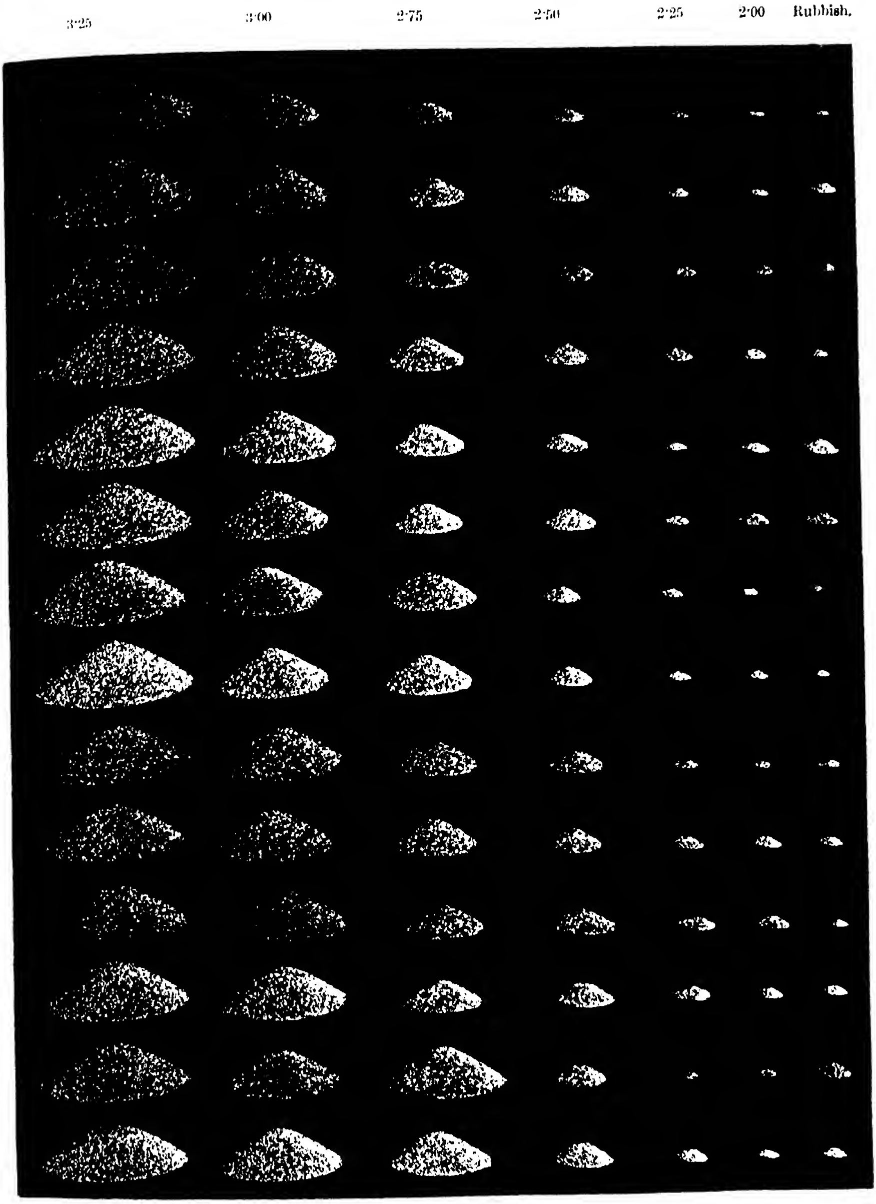


Fig. 16 To show the proportion of large and small grains in each variety.

1. Algerian.
2. White Essex.
3. Tardent's Blue.
4. Zealand.
5. Marshall's 8.
6. Marshall's 3.
7. Australian Talavera.
8. White Lammas.
9. Early Baart.
10. Steinwedel.
11. Hudson's Early Purple Straw
12. Farmer's Friend.
13. White Naples.
14. King's Jubilee.

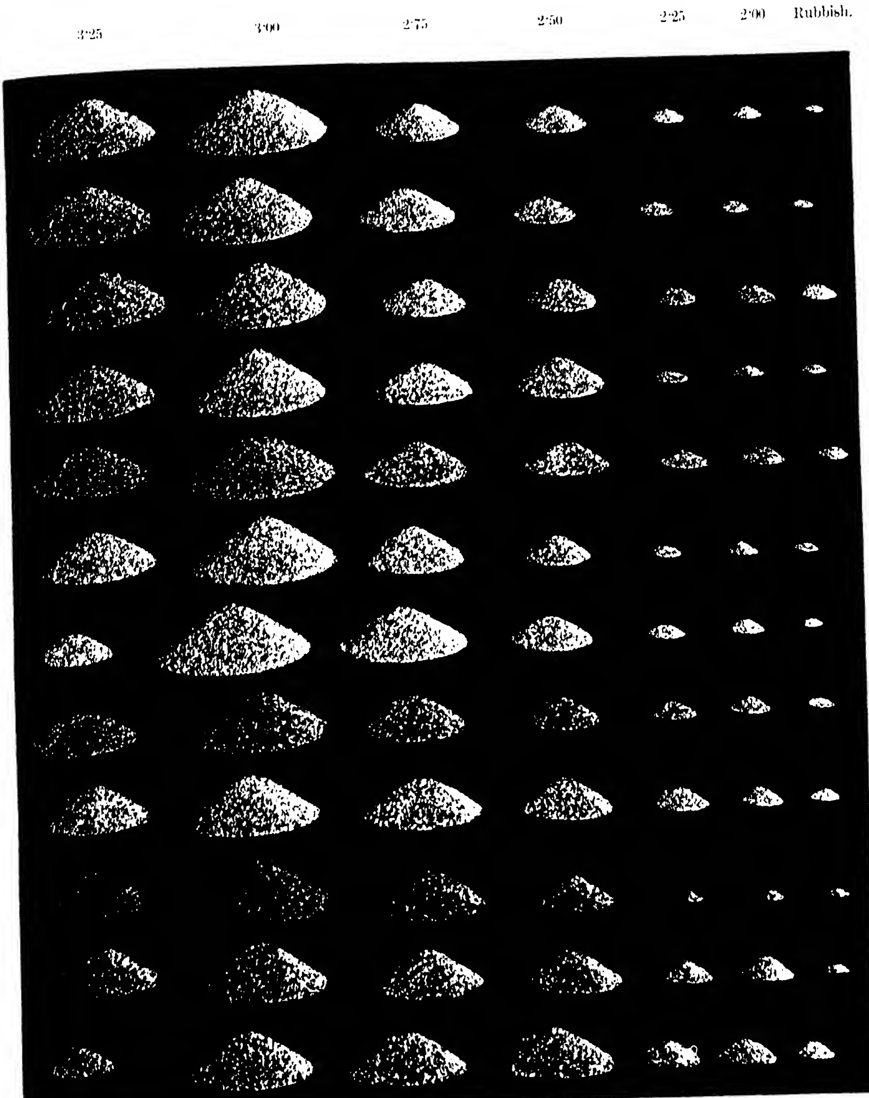


Fig. 17.—To show the proportion of large and small grains in each variety.

15. Red Straw.
16. Golden Drop.
17. Rattling Jack.
18. Allora Spring.
19. Canning Downs.
20. Talavera de Bellevue.

21. Budd's Early.
22. Early Para.
23. White Velvet.
24. White Tuscan.
25. Velvet Pearl.
26. Blount's Lambrigg.

however little difference it may make to the more perfect milling outfits to be found in the metropolis and in other parts of the world to which Australian wheat is exported.

When an Australian, or at least a Riverina, miller in future hears a wheat mentioned by name, he can, if the variety be not familiar to him, by referring to the foregoing table, find out at once how it will act in his riddles and rollers,—that is, of course, so far as size is concerned—and it is needless to say that ofttimes this information will determine whether he can use the variety to advantage.

It is also needless to say that the facts herein explained will henceforth be available in characterising the various varieties of wheat, as grown in the principal wheat district of this country.

Judging the Milling Qualities of Prize Wheats at Shows, &c.

F. B. GUTHRIE AND E. H. GURNEY.

From time to time the Department has been asked to assist the judges at different agricultural shows in judging samples of wheat competing for prizes.

A short discussion of the methods employed, and a comparison of our results with those independently arrived at by the judges in each of these cases, cannot fail to be of interest to buyers and sellers of wheat. The report furnished by us was based in all cases upon the actual behaviour of the sample in the mill, and it is clear that such a system, if it can be properly carried out, has many advantages over that of judging by appearance only, even when the judges are expert buyers.

One indisputable advantage lies in the fact that it is based on actual results obtained, which results can be presented on a numerical basis.

Guesswork judging is thus done away with; and an award which is made on the actual behaviour of the wheat on milling is not open to the objections which can be urged against the unsupported opinion of a judge, however experienced he may be.

A further advantage which will commend itself to those who favour the system of single judges is that one judge can do the work of three or more.

The only objection to the system is that it occupies more time than the present method of judging from the appearance only, but this is a small price to pay for the increased accuracy gained. This time, moreover, could be very considerably shortened if an expert miller were present whilst the samples were being treated, for in many cases we have laboriously gone through all the stages with a wheat which an experienced miller would have felt justified in rejecting at an earlier stage.

The method is, no doubt, imperfect in its present form, and capable of improvement, and it is in the hopes of getting suggestions for its improvement that we lay it before the readers of the *Gazette*.

If the system can be made reliable and exact, it is obviously of the very greatest importance, not only in awarding prizes at shows, but in all cases of buying and selling wheat. At present it no doubt often happens that the buyer, on account of a suspicion as to the milling qualities of a wheat, refuses to pay its full value, being afraid to run any risks. On the other hand, even the most experienced buyer may be deceived by the appearance of a grain for which he afterwards finds that he has paid too high a price.

A means of submitting the sample to a reliable practical milling-test would be in the interests of both farmer and miller. How far the method we have adopted fulfils these conditions we leave our readers to judge.

The milling was done on the small hand roller-mills, and by the method already described in detail in a previous number of the *Gazette* (March,

1895). The points for which the grain was particularly examined were the following:—

1. Appearance of grain.
2. Weight per bushel (in pounds).
3. Ease of milling.
4. Percentage of flour obtained.
5. Colour of flour.
6. Percentage of gluten in flour.
7. Strength of flour (in quarts of water per sack of 200 lb.).

Of these characteristics the gluten-content and the strength of the flour were regarded as being the most important, and 20 marks were awarded as the maximum for each. The weight per bushel of the grain and the colour of the flour were marked next in order, receiving each 15 marks, 10 marks being the maximum assigned in each case for appearance of grain, ease of milling, and quantity of flour obtained on milling.

The wheats here discussed were, it must be remembered, wheats competing for prizes; consequently, the question of their suitability for blending purposes did not arise, and they were examined as to their suitability for milling by themselves.

The marks assigned are, therefore, only intended to apply to the particular case in point, and might be altered according to the judgment of the individual buyer.

The Grenfell P., A., H., and I. Association have forwarded for the past three years a few of the best samples competing at their annual show, in order to have their milling qualities practically tested. A short discussion of the results obtained in each year will afford a very good indication of the usefulness of the method adopted.

In 1895 six samples were sent, selected as being the six best of the wheats competing.

The following table gives the result of the examination:—

WHEATS examined for the Grenfell P., A., H., & I. Association for the 1895 Show.

	Appearance of Grain.	Weight per Bushel.	Ease of Milling.	Percentage of Flour.	Colour of Flour.	Gluten.	Strength.	Total.
Maximum marks .	10	15	10	10	15	20	20	100
No. 3	10	15 (62·9)	10	9 (74·2)	15 (C)	18 (9·4)	19 (47·0)	96
No. 16	9	12 (61·2)	10	8 (72·6)	14 (B_1)	20 (11·6)	19 (47·0)	92
No. 21	9	12 (60·6)	10	9 (74·5)	14 (C_1)	16 (8·1)	20 (48·0)	90
No. 12	8	12 (60·6)	10	10 (76·0)	14 (C_1)	15 (7·5)	19 (47·5)	88
No. 14	8	14 (62·5)	9	9 (73·4)	14 (C_1)	15 (7·5)	18 (46·8)	87
No. 4	8	13 (61·8)	9	8 (71·6)	15 (C)	16 (8·3)	16 (44·0)	85

Explanation of Table.

The figures in brackets are those actually obtained. It will be seen that the only marks which are not referable to a numerical basis are those given to ease of milling and appearance of grain.

As all the wheats examined are of nearly the same type, and easy milling wheats, the marks assigned for ease of milling do not materially affect the result. In the only other case where the "personal factor" is predominant—the appearance of the grain—the maximum of marks is purposely low, so as not unduly to influence the results.

It is further important to remember that the marks are only assigned in order to compare wheats of the same batch, and are not intended to afford any comparison between these wheats and those of other batches; that is to say, the wheat in the above table gaining 96 marks is not necessarily better than the one gaining 95 in the next table, or worse than the one to which 98 marks is assigned in the 1897 batch.

The following notes accompanied the table:—

No 3 is the best all-round wheat.

No. 16. Very rich in gluten. Valuable to blend with weaker wheats such as No. 4; but not up to No. 3 in weight per bushel, nor yield and colour of flour.

No. 12. Very floury wheat; poor in gluten; flour not very good colour, and less rich in gluten and strength than No. 21.

No. 4 yields only small quantity of very weak flour; might be useful for blending with such wheats as No. 12 and No. 16.

The order in which the wheats were placed by the judges was not quite the same, No. 21 being awarded first prize; then No. 16 and No. 3, Nos. 12 and 14 being bracketed as equal; the essential difference being that Nos. 3 and 21 changed places.

WHEATS examined for the Grenfell Show of 1896.

	Appearance of Grain.	Weight per Bushel.	Ease of Milling.	Percentage of Flour.	Colour.	Gluten.	Strength.	Total.
Maximum marks ..	10	15	10	10	15	20	20	100
No. 1	10	15 (62·9)	10	8 (70)	15 (C)	18 (10·74)	19 (54)	95
No. 3	8	12 (61·1)	10	9 (71)	15 (B_4)	17 (10·05)	20 (55)	91
No. 4	8	12 (61·0)	10	10 (72)	14 (C_1)	19 (11·98)	17 (52)	90
No. 5	7	11 (60·0)	10	7 (69·5)	15 (C)	19 (12·09)	19 (54·5)	88
No. 2	6	12 (61·0)	10	9 (71)	13 (C_2)	20 (12·92)	17 (52)	87
No. 7	7	11 (60·5)	10	8 (70)	13 (C_2)	20 (13·27)	16 (51)	85
No. 6	6	10 (59·1)	10	7 (69)	15 (C)	18 (10·81)	17 (52)	83

The following notes accompanied this table:—

All samples are easy milling wheats.

No. 1 by far the best for milling alone.

Nos. 7, 2, and 5 are high in gluten, and should be good for blending with weaker wheats.

There is little to choose between Nos. 3 and 4.

On this occasion our report did not reach the Secretary, Mr. G. Cousins, until the day of judging, and the awards had been already given. The judges' decision was identical in every particular with our own.

WHEATS examined for the Grenfell Show, 1897.

	Appearance of Grain.	Weight per Bushel.	Ease of Milling.	Percentage of Flour.	Colour.	Gluten.	Strength.	Total.
Maximum marks ..	10	15	10	10	15	20	20	100
No. 9	10	15 (63·1)	10	10 (75·3)	14 (C_1)	19 (12·1)	20 (52·0)	98
No. 17	9	12 (61·8)	10	10 (75·2)	14 (C_1)	19 (11·5)	18 (47·0)	92
No. 16	10	15 (63·3)	10	9 (74·3)	12 (C_2)	19 (11·3)	17 (44·8)	92
No. 1	10	13 (62·5)	10	8 (73·0)	15 (C)	18 (9·5)	17 (45·2)	91
No. 5	8	13 (62·5)	10	10 (76·0)	12 (C_3)	19 (10·8)	18 (47·0)	90
No. 6	8	12 (61·3)	10	9 (74·4)	11 (B_1)	20 (13·6)	20 (54·6)	90
No. 18	7	12 (61·9)	10	8 (73·3)	12 (C_2)	20 (13·8)	20 (50·6)	89
No. 10	8	12 (61·7)	10	9 (73·8)	10 (C_5)	20 (13·1)	19 (49·4)	88
No. 15	8	12 (61·4)	10	7 (71·2)	15 (C)	18 (9·6)	18 (46·8)	88
No. 14	7	11 (59·4)	10	7 (71·9)	11 (C_4)	20 (14·0)	18 (47·2)	84

Order of Merit.—No. 9, 16, 17, 1, 5, 6, 18, 10, 15, 14.

The following notes accompanied the table :—

All easy milling wheats.
No. 9 best for milling alone.
Nos. 6 and 18 strong and good for blending.
No. 16 given preference over No. 17 because of greater weight and better appearance of grain, though No. 17 yields more flour and of a slightly better colour.
Some of the gluten-contents are very high, consequently the maximum marks are given to all with gluten-content of over 13 per cent.
The colours could in all cases have been improved. The milling was perhaps a little severe.
This is a good batch of wheats, and is the best batch of prize wheats yet received, the first four samples being particularly good and uniform in appearance.

In this case our report reached the Secretary before the Show, and Mr. Cousins tells me the judges (three in number) knew and saw nothing of it until they had made their award. The awards were then compared, and the order in which the wheats had been placed was found to be again identical with our own, with this exception, that Nos. 5 and 6, which had been

bracketed as equal in our list, were differentiated by the judges, the fifth place being given to No. 5, and the sixth to No. 6. In all other particulars the awards were identical, a result which was certainly astonishing considering the relatively large number of wheats compared.

Mr. Cousins tells me that in this case the judges took the weight of the samples in addition to judging by appearance. I do not know if this is always done, but it undoubtedly should be.

At the Wagga Wagga Show, April, 1895, a prize of £100 was offered by the Murrumbidgee P. and A. Association to be divided amongst the exhibitors of the six best samples of wheat fulfilling certain conditions.

The first six of these wheats were forwarded for examination and report. The results of the examination appear in the following table:—

WHEATS examined for the Wagga Show, April, 1895.

	Appearance of Grain.	Weight per Bushel.	Ease of Milling.	Percentage of Flour.	Colour of Flour.	Gluten in Flour.	Strength of Flour.	Total.
Maximum marks ..	10	15	10	10	15	20	20	100
Distinguishing No.								
No. 10	10	15 (65·9)	9	10 (75·2)	15	17 (8·5)	20 (48·8)	96
No. 2	10	15 (65·8)	9	7 (71·0)	13	20 (10·4)	16 (46·5)	90
No. 7	9	14 (65·0)	9	9 (74·5)	13	18 (9·0)	18 (47·8)	90
No. 4	9	12 (63·9)	9	8 (72·0)	14	13 (6·7)	17 (47·0)	82
No. 11	8	12 (63·8)	9	8 (72·5)	15	14 (7·3)	15 (46·0)	81
No. 1	6	13 (64·3)	10	7 (71·6)	11	17 (8·6)	12 (43·2)	76

The wheats were all milled in exactly the same manner, and presented no peculiarities worth noting. The high numbers under the heading "weight per bushel" are due to their all having been previously well cleaned.

Grain No. 1 was weevily. No. 11 was not cleaned as well as the others. It will be seen that No. 10 was much superior to the others.

The judge's final award was made in the order given in the above table, with the following exceptions:—No. 2 and No. 7 were differentiated, and the second prize awarded to No. 2, as No. 7 was found to be less clean when examined in bulk; No. 1 was rejected altogether, and another grain substituted for the sixth prize.

Here again the judge's award was practically identical with ours. As the money-value of the prize was in this case a high one, the agreement is particularly gratifying.

The next table shows a comparison beween two wheats which gained special prizes at the Forbes Show of 1896. It is inserted here because the competing wheats were of different types, the one being a Purple Straw and the other of the White Lammas type.

WHEATS examined for the Forbes Show, 1896.

	Appearance of Grain.	Weight per Bushel.	Ease of Milling.	Percentage of Flour.	Colour.	Gluten.	Strength.	Total.
Maximum marks ..	10	15	10	10	15	20	20	100
A. White Lammas.	9	14 (63·7)	10	9 (74·0)	15	20 (7·1)	20 (52·0)	97
B. Purple Straw	10	15 (64·2)	10	10 (75·0)	15	18 (6·0)	18 (48·0)	96

The wheats, it will be seen, are both excellent milling wheats, and there is considerable difficulty in differentiating them, which was no doubt the reason they were sent to us.

The point of particular interest in the above is that the high marks accorded to gluten-content and strength have turned the scale in favour of the Lammas wheat, the flour of which is particularly good in this respect.

The Purple Straw grain was somewhat better in appearance, in weight per bushel, and in yield of flour, but according to the scale of points adopted, these advantages are outweighed by the far superior strength and gluten-content of the flour from the White Lammas.

It will be at once seen that if the three points in which the Purple Straw has the advantage received the higher marks, and if the falling off in these points were more severely punished, the relative positions of the wheats would have been reversed. The value of the examination remains the same in furnishing an accurate basis for the final opinion.

We regret to say that we do not know whether the judges' award agreed in this case with our own.

Chemical Notes.

F. B. GUTHRIE.

Prepared Bone-meal.

In a previous issue of the *Agricultural Gazette* (April, 1897), I drew attention to the exhaustive experiments conducted by Professor Märcker, of Halle into the fertilising value of the phosphate of lime in bone-dust.

A comparison, under all sorts of conditions, of the effects of bone-dust with those produced by phosphate of lime in other forms, such as superphosphate and Thomas slag, forced him to the conclusion that bone-meal is of relatively low value as a phosphatic fertiliser, whether in its immediate results, or in its effect upon succeeding crops.

To quote his own words, "Such a conclusion would have a very unwelcome result were it not possible to treat bone-meal in a cheap way, so as to make it effective," and this can be done by treating it with a small quantity of sulphuric acid.

He prophecies also that the future of the bone-meal industry lies in the preparation of such products.

The proportions which he has found most efficacious for this purpose are as follows:—

Every 100 lb. raw bone-meal is treated with 20 lb. sulphuric acid of 60 degrees Beaumé. This is insufficient acid to convert the phosphate of lime into superphosphate, and a little more than is required to convert it into the intermediate bi-calcium phosphate.

This product Professor Märcker found to be almost equal to superphosphate in its immediate effects, and if anything superior in its action in the succeeding crops.

Pending the time when we shall be able to carry out this class of experiments for ourselves in a satisfactory manner, it may be of interest to *Gazette* readers to know what effect the addition of this quantity of sulphuric acid has on the solubility of the phosphate of lime, and its availability to plants.

With this object, a sample of bone-dust was treated with acid in the above-mentioned proportions, and examined after three weeks' standing, and again in two months' time. The analyses are due to Mr. E. H. Gurney.

The original bone-dust had the following composition:—

Moisture	5·59
A—Volatile and organic	34·63
Insoluble	0·23
B—Tri-calcium phosphate...	54·89
Other lime-salts calculated as carbonate	5·31
	100·65
A—Containing nitrogen	4·06
Equivalent to ammonia	4·93
B—Containing phosphoric acid	25·14

The phosphoric acid in the above bone-dust is, for all practical purposes, insoluble both in water and ammonium citrate. The mixture was made on 15th June, and examined on 6th July, with the following result:—

Water-soluble phosphoric acid		11·38
Citrate-soluble phosphoric acid	=	9·74
Insoluble phosphoric acid	=	4·02
		25·14

The compound was again examined on 16th August (nine weeks from the date of mixing), and was found to be practically unchanged:—

Water-soluble phosphoric acid	=	11·34
Citrate-soluble „ „	=	9·38
Insoluble „ „	=	4·42
		25·14

In other words, nearly five-sixths of the original phosphoric acid had been converted into soluble lime-compounds, and the bone-dust had the characteristics of a quick-acting phosphatic fertiliser.

The small amount of acid required renders the product very easy to dry, and it is unnecessary to add any drying material. Exposed to air and sun, it becomes friable and ready for use in a few hours time.

The fact that it is a less acid manure than superphosphate is also of considerable advantage on soils poor in lime, such as we have to deal with for the most part.

Here is the analysis of another "prepared bone-meal," manufactured in a similar way by a correspondent.

In this case a much larger proportion of sulphuric acid must have been used, as the mixture was too moist to sample properly, and had to be artificially dried before being examined.

The manure was also strongly acid, and is of the nature of a superphosphate.

Analysis of dried Sample.

Moisture	=	3·83
A—Volatile	=	46·08
Insoluble	=	2·87
Lime (CaO)	=	20·92
B—Total phosphoric acid (P_2O_5)	=	16·30
A—Containing nitrogen	=	5·52
Equivalent to ammonia...	=	6·70
B—Composed of—		
Water—Soluble phosphoric acid	=	12·70
Citrate—Soluble „ „	=	1·38
Insoluble „ „	=	2·22
		16·30

Mixing Thomas Slag and Nipho.

Nipho being a purely nitrogenous manure, it is seldom advisable to apply it alone. Phosphatic manures, and manures containing potash, must be added in order to make a complete fertiliser.

One of the best phosphatic fertilisers is "Basic slag" or "Thomas phosphate."

One of our correspondents having expressed a fear lest the addition of this compound to nipho should result in a loss of ammonia from the latter, the matter was carefully tested by determining the nitrogen before and after mixing.

The sample of nipho used for the experiment contained 12·06 per cent. nitrogen, equivalent to 14·64 ammonia.

It was mixed with slag in the following proportions:—

I. One part basic slag to one part nipho.

II. Two parts basic slag to one part nipho.

If no nitrogen were lost, I should contain 6·03 per cent. nitrogen, and II 4·02 per cent. nitrogen.

The above mixtures were examined in about a week's time with the following result:—

I. Contained 6·21 nitrogen, instead of 6·03;
Equivalent to 7·54 ammonia, instead of 7·32.
II. Contained 3·92 nitrogen, instead of 4·02;
Equivalent to 4·76 ammonia, instead of 4·88.

Showing that in the proportions used no loss of nitrogen occurs within a week's time when basic slag and nipho are mixed. The figures, it will be seen, are not exactly the same, and in the first case there appears to be a slight gain in nitrogen. This is due to the fact that the quantities used for mixing were relatively large, and the weighing done on a comparatively rough balance, whereas the nitrogen determination was made with all possible accuracy.

Ash of Gidgea Acacia (Stinking Wattle).

A sample of the ash of this plant, forwarded by Mr. A. Andrews from the neighbourhood of the Pera Bore, was examined some time ago. As the composition of this ash is peculiar, and quite different from that of the ash of any other timbers I have examined, the analysis is appended herewith:—

Analysis of Ash of "Gidgea Acacia," grown at the Pera Bore.

Insoluble and sand ...	= 1·84
Carbonic acid (CO_2) ...	= 39·46
Silica, oxides of iron, and alumina ...	= ·63
Lime (CaO) ...	= 53·19
Magnesia (MgO) ...	= 1·61
Potash (K_2O) ...	= ·29
Soda (Na_2O) ...	= ·36
Phosphoric acid (P_2O_5) ...	= ·81
Chlorine (Cl) ...	= ·02
Sulphuric acid (SO_3)...	= ·96
	99·17

Analysis of pure Ash, exclusive of sand, charcoal, and carbonic acid.

Silica, oxides of iron, and alumina ...	= 1·17
Lime (CaO) ...	= 90·71
Magnesia (MgO) ...	= 2·74
Potash (K_2O)...	= ·60
Soda (Na_2O) ...	= ·72
Phosphoric acid (P_2O_5) ...	= 1·47
Chlorine (Cl) ...	= ·04
Sulphuric acid (SO_3)...	= 1·72

Referring to the first of these tables, which represents the composition of the ash when burnt in the usual manner, it will be seen that it consists almost entirely of carbonate of lime, 53·19 per cent. lime being equivalent to 93 per cent. carbonate of lime. Mr. Andrews says it is largely used for polishing, and for white-washing fire-places, cleaning knives, spoons, and other things that knife-polish is used for. As a matter of fact, it is very

similar in composition to ordinary chalk or whitening, and Mr. Gorman tells me that one of the hands on the Pera Farm has done quite a finished piece of French-polishing with it.

Gidgea is a wood that burns completely to ash, both in the green and the dry state. Once alight it burns completely away, leaving a fine white ash.

The Gidgea country is in the calcareous land west of the Darling. Gidgea prefers sandy or loamy soil, where it grows very thickly; in fact, it takes possession of the land. Its average height is 25 to 30 feet. Its wood is excessively hard, making splendid posts and rails, which stand well, and are almost proof against the white ant.

The leaves of *Gidgea Acacia* contain a high percentage of albumenoid substances. The following is a partial analysis of a sample of the leaves:—

Water	= 35·26
Albumenoids (N × 6·25)	= 17·43
Albumenoids calculated to dry substance	= 26·92

I have, however, never heard of stock touching it on account of its offensive smell.

The Kerry Cow.

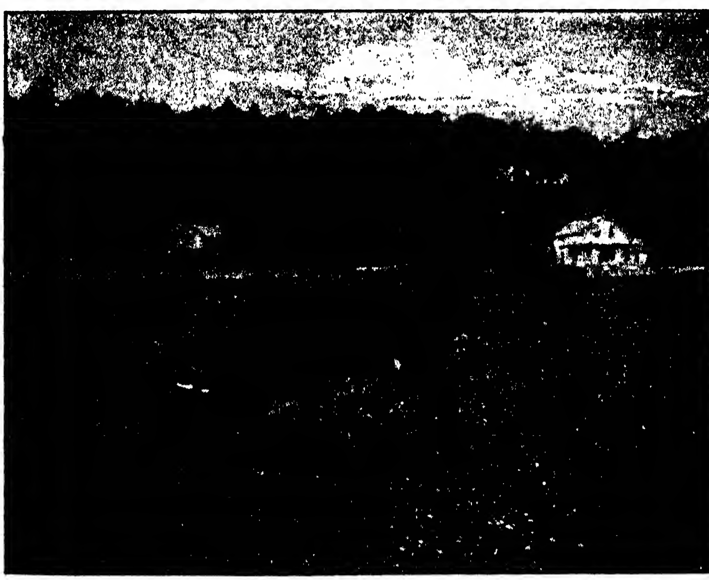
M. A. O'CALLAGHAN.

THE Kerry is the only pure breed of Irish cattle. Bred among the mountainous districts of Kerry, the breed was until recently little known outside the fastnesses of its own picturesque county, where it had long become noted for its ability to yield a good supply of rich milk even on poor fare, and to withstand the cold and seek for food where most other breeds

Kerry Cow.

of cattle would starve. Owing to this trait, it received the name of "The poor man's cow." A few years ago, however, the breed, aided by the efforts of a few enterprising gentlemen, jumped into prominence—prizes were offered for the best specimens of the breed at the principal Irish shows; English visitors thus became acquainted with the breed, and at once recognised its beauty and utility. Soon a sort of fashion craze set in throughout England in favour of the beautiful little blacks, and no demesne or park was deemed complete unless their shining ebony coats were in

evidence. Good prizes were offered in the classes which were readily provided for this breed at the principal English shows, and a strong demand set in, so that breeders and dealers enjoyed a very good time for a couple of years, until the bulk of the English demand got satisfied. Some of the very best specimens of the breed were sent to England; good results followed from these, and English breeders were able to hold their own against the best that Ireland could send there to compete. On the other hand, many inferior or indifferent cattle were exported to England. Englishmen were not judges of the breed, and got "let in" a bit by dealers; and this had rather a damaging effect both on the demand and on the popularity of the breed. At the same time, I do not know of a more uniform breed, or one in which is found a greater number of good specimens. Simultaneous with its development into prominence was its enrolment among the ranks of aristocracy, and with an unimpeachable hereditary line dating further back than the Shorthorn or the Ayrshire, this breed became eligible for herd-book purposes, and to the credit of those interested, one was immediately formed on the very best lines, and to-day no Kerry is deemed up to much whose genealogical tree is not to be found in one of the annual copies of this book. In



Kerry Heifer.

establishing this herd-book the following system was adopted:—A committee of judges was appointed, the very large herds were visited, and all that were accounted pure and typical by this committee were eligible for entry. Besides this, an annual fair or assembly was held in Killarney, where breeders sent the cattle for inspection by said committee, and all that passed their critical eye were entered in the herd-book. Now the produce of these are entered annually. The directors of this herd-book are extremely particular, and, in fact, at one time incurred odium in consequence of their severe

strictness regarding the question of colour. Just as at one time a Jersey of broken colour was deemed an outsider, the Kerry of to-day must be black, and black only, even the faintest spot of white on the flank being sufficient for disqualification. The udder is the only exception made, this being white, and a trace of white on the underline near the udder is not objectionable. The cow is in height somewhat less than that of the Jersey, but is of a stronger and hardier build, and more robust constitution. The coat is close, and thickens and lengthens towards winter. The body is set on rather short legs, fine in bone; she is light before and heavy behind, or, in other words, of the "wedge" shape, which is recognisable in the best specimens of all dairy breeds. The head and horn form one of the distinctive features of this breed. The horns, which are fine, with black points, must turn upwards with a backward tendency, and curve slightly inwards. The neck is fairly long and fine, with no loose skin about the brisket, and the whole appearance of the animal must be one of grace and beauty. The illustration, page 870, will give readers an idea of the appearance of a good Kerry. This cow was yielding 5 gallons (20 quarts) of milk a day at the time the photo. was taken. She is a typical cow, and a prize-taker. She is the property of Mr. R. Barter, J.P., St. Annis Hill, county Cork, Ireland, and obtained First Prize at the Show of the R. A. Society of England held recently at Manchester, thus entitling her to rank among the best specimens of the breed in existence.

The Kerry is credited with yielding the greatest quantity of milk in proportion to its size of any pure breed. Its milk ranks next in richness to that of the Channel Island cattle (Jersey and Guernsey), hence its reputation as a dairy-breed stands high, especially with people possessing only small plots of land, and who keep dairy-cows only to supply milk for home purposes. One of the animals imported into England has a record of 1,120 gallons of milk in a year, an almost incredible yield for such a very small cow. Well-bred heifers, on their second calf, yield about an average of 450 gallons in a ten months' milking. It might be stated that typical Kerries cannot be bred outside their own native country, for when they are brought up on rich pastures many of their characteristics alter—they grow into a much bigger and heavier animal, requiring more food, but do not lose their milking properties.

Kerry cattle fatten pretty readily, and when fat the meat is excellent, the fat being well mixed up with the lean, or what is known as "well marbled." Crossed with the Durham, a very useful animal of medium size is obtained.

I am of opinion this breed would do remarkably well on the lighter lands of Australia, and in periods of drought it should show up very prominently, as it is marvellous the condition these little animals maintain under the scantiest of fare.

The Dexter Kerry.

This is a species of the breed possessing all the good milking properties of the Kerry proper, but is a much smaller animal, and of coarser build and bone. It does not possess the graceful outline of the true Kerry, being a thick-set animal standing on short legs, and more of a beefy type. In colour this animal may be either black or red; the head is heavier and bolder than that of the Kerry; the horns grow straight out or curve slightly inwards. A peculiarly distinctive feature of this animal is that its hind legs just above the feet are crooked. The thicker the body and the shorter the legs on this animal, the more it is admired. Many people prefer it to the true Kerry. It is difficult to say with any certainty how this animal was

produced. Some are of opinion it was originated by crossing the Kerry cow with a Welsh bull, while there is a story in Kerry county that it was produced by a seal mating with a Kerry cow. Much difficulty has been experienced in breeding pure Dexters, the calves being mostly deformed. I have seen them double-headed, six-legged, and some whose heads certainly looked more like those of bull-dogs than of calves, and at the present day I

Dexter-Kerry Cow (property of Mr. R. Barter.)

think most of the Dexters produced are simply a cross between a Dexter bull and a pure Kerry cow. Among the most successful breeders and exhibitors of Kerries are Messrs. M. Sutton, Reading, England; R. Barter, Cork; J. Robertson, Dublin; the Earl of Clonmel; T. Rattery, Ballybunion, &c. The Prince of Wales has a celebrated herd of Dexters, with which he wins many prizes.

San Jose Scale (*Aspidiotus perniciosus*, Comstock).

By WALTER W. FROGGATT,
Government Entomologist.

During the last few years there have been more papers and reports written about this insignificant-looking little scale insect than of any other member of the great coccid family.

Nearly every American publication dealing with agriculture or practical entomology has something to say about this destructive pest, which has spread so rapidly all over the United States, causing the death and destruction of thousands of trees; for, unlike most of the coccids which cause trees to become disfigured and unhealthy, this scale if neglected soon kills the trees outright. Though it has been found that in some States it is a much more destructive pest than in others, and that the same treatment will not check it in different districts, yet up to date it may be safely said that it is the most dreaded scale which has attacked the orchards of the world.

Anybody working at economic entomology will have been struck with the boom in "coccid" literature during the last year or two, and this is to be accounted for from the fact that this family contains an immense number of most destructive creatures which are easily transported from one end of the world to the other on introduced trees and plants. Many are often so small that it takes an experienced eye to detect their presence, and though we have already in New South Wales a large number of the worst scale insects, still there are a good many from which we are as yet free, and a strict inspection of all plants arriving on the borders of the Colony, and the oversight of all nurseries importing plants from abroad, should be enforced with as little delay as possible.

A number of writers are describing new species from all parts of the world, many of which when examined by experts will probably be found to be only local varieties of well-known species, and this is to be regretted when already there is such a burden of synonyms hanging round the necks of most of our common species.

The San Jose scale has been in existence in New South Wales and some of the other colonies for several years. As far as I can learn it has been looked after and checked, if not stamped out, both in Victoria and South Australia. It is not the case in this Colony, and, though not an alarmist, I would strongly urge all orchardists who have trees affected by any unknown or obscure disease, where the trees appear unhealthy or stunted from no reasonable cause, to forward branches to the Entomological Branch for examination.

San Jose Scale (Aspidiotus perniciosus, Comst.)

A. Adult Female (much enlarged), after Howard. Adult Female, Anal Segment (highly magnified), after Howard
B. Stem of Apple-tree thickly covered with Adult Female Scales (enlarged original).
C. Lady-bird Beetle (Rhizobius debelis, Blackb., enlarged) found feeding upon scale in orchard, Berowra, N.S.W.
D. 1, showing spray of Apple-tree clean, without Scale, as it appears at the present time.
2, showing spray, badly infested with San Jose Scale, cut off a dying tree at the same date, Gosford, N.S.W.

That the San Jose scale was introduced into Sydney from California by a nursery firm some four or five years ago upon apple or pear stocks, there cannot be the least doubt, for in every instance where it has been discovered the trees from which the infection spread have come from the same place. Of course, this was unintentional on the part of the firm, as the scale in its early stages is very hard to detect, even by a trained eye, and as soon as it was reported to them they burnt all their remaining stocks, but the effect was disastrous all the same, for it had been distributed all over the Colony before these steps were taken. It was first reported in New South Wales by the late Mr. A. S. Olliff, in the *Agricultural Gazette*, 1892, upon pear-trees near Maitland, and Mr. Maskell states that he again received specimens from this gentleman in 1895 upon peach and apple trees, while Mr. French sent specimens on peach-trees from Victoria in 1894. Though this scale was unnoticed for some time, it was evidently flourishing all the time, and early last July specimens were received from near Tamworth, attacking some young apple-trees.

I visited this orchard (which fortunately is an isolated one), and found eight trees in a row more or less infested. They were about 4 years old, but, though purchased in Sydney, the owner could not tell me from whose nursery. The central tree had its trunk and main branches blackened with the multitude of scales infesting it, and from this one I think it had spread up and down the row. I treated these trees with very strong 25 per cent. kerosene emulsion, and am waiting for results this coming season.

When visiting the New England district in September, at an orchard near Tenterfield, the owner showed me two trees which he said had never done any good since he had planted them, some four years ago, and careful examination showed that the bark of the trunk and main limbs were thickly infested with San Jose scale. These trees had been purchased from the Sydney nursery previously referred to, but the scale had not spread on to any of the adjacent trees.

At Inverell one of the leading orchardists asked me to visit his place and examine some "sick trees," which I found to be also attacked by this scale, and though most of the larger trees had been well sprayed in the winter, a few live scales were found upon them. In the Tenterfield orchard the trees attacked were apple. Here cherry, apples, and peaches were infested, in the latter the bark being swollen out in ridges upon the smaller branches. The owner showed me a small, stunted apple tree, about 5 years old, also obtained from the same Sydney nursery from which he believed the other trees had become infested. It was still alive, but so stunted and sickly that from a distance one could see that it was unhealthy, and so thickly was its bark covered with this scale that it was a wonder it still survived. From my observations in these two orchards I came to the conclusion that in the New England district the cold climate is against the rapid spread of this scale, for though the pest had existed for at least four years in this orchard, it had attacked only half a dozen trees. It should, therefore, not be a hard matter to rid an orchard of the scale in this district if taken in hand when the pest first appears.

In October I went over an orchard near Gosford, which is simply swarming with San Jose scale. Nearly half the trees in the place are more or less seriously infested, apples, pears, plums, and peaches being attacked indiscriminately. In this place many of the apple-trees are dying, and will not live over another season. The bark of those in this stage is rough, and cracked upon the upper part, and below upon the trunk roughened and

discoloured. Curious to remark, upon some healthy apple-trees, growing near some of the bad specimens, the scale was found only upon the young wood of last year's growth, forming a ring round each branch for several inches.

The scale is also in existence in one large orchard at Maitland, where it has increased in spite of regular spraying.

Peach-trees, when attacked by this scale, have the branches quite ribbed with distinct hollows in the bark, but sometimes swollen and flattened on the sides, so that even the tissue of the wood seems to have been altered.

It is somewhat difficult to describe such a small scale as this in general terms so that an orchardist can identify his enemy, while the insect (the adult female) is so small when removed from her test, that it takes a high-power objective on the microscope to make out her specific characters. The diameter of the scale covering a full-grown coccid is not more than one-twenty-fifth of an inch in diameter, this test being circular in form and varying in colour from gray to black, with the central knob (pellicle) yellow or reddish-brown. Where the scales are scattered on the young wood their presence is noticed from the purple stain they impart to the surface of the bark. When overlapping each other, as is the case when the trees are badly infested, the bark looks as though it was covered with a granulated, dark, grayish-brown substance that had been plastered over the branches and completely hidden the surface of the bark. Upon a branch thus coated it is only with a lens that one can differentiate the separate scale. When thus infested, the branches, if not dead, have only the terminal bud putting forth leaves, the other buds along the sides of the shoot having failed to burst out on account of all their substance being sucked up by the countless millions of these little coccids. Therefore, a badly infested one at this stage can be easily noticed in an orchard among healthy trees.

I have never seen this scale upon the fruit or foliage, though it is common enough in America, and would be doubtless found in an orchard like the one at Gosford in the fruit season, and if fruit is sent out of an infested orchard this would be one of the easiest ways of scattering it still further over the Colony. The larvæ were crawling all over the twigs taken from the Gosford orchard in the middle of October, so early in October if the season has been warm, and a few weeks later if the season has been cold, and for a month or two afterwards would be the time when these minute creatures would be most easily carried all over the adjoining gardens.

The San Jose scale was first described by Professor Comstock* in 1880 from orchards in the valley from which it takes its popular name; at that early date it was a well-known pest, and was said to have been introduced from South American ports some ten years before, but like a great number of the common coccids which have been distributed all over the world within the last few years, its exact habitat will always remain an open question. Later writers suggest that it is a native of Japan, but in our case we received it from California some years ago.

In 1895 Mr. W. M. Maskell furnished a paper to the *Agricultural Gazette*, New South Wales (p. 868†), upon the identity of this species with another described by him from Victoria, and came to the conclusion that they were identical; in that paper he gives a lot of interesting notes on this scale.

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* Report of the Entomologist of the U.S. Dept. of Agric., 1880, p. 304.

† The Pernicious or San Jose Scale and *Aonidea fusca*: a question of identity or variation.

In 1896 the entomological division of the Department of Agriculture, U.S.A., issued a Bulletin, "The San Jose Scale: its occurrences in the United States, &c."; by L. O. Howard and C. L. Marlatt. This contains an exhaustive account of this pest up to date, and its ravages in the various States; its habits and life-history; parasites and natural enemies; remedies and preventives; concluding with a bibliography, wherein some ninety-three papers dealing with it, are tabulated.

Here we find that it was from the nurseries that the San Jose scale spread, especially some of the larger ones in New Jersey; as with us, this was undoubtedly unintentional, but the results have been disastrous to fruit-growers there as they may be with us. One thing to be noted in this report is that the methods employed in California and the other Pacific States were found to be useless against the scale in the eastern States.

The lime, sulphur, and salt wash is always used in California as a winter wash, and the resin wash both as a winter and summer wash—chiefly the former; but kerosene emulsion is always used as a summer spray.

The soap-wash treatment was found to be the most successful spray in the eastern States on a large scale, killing more scale than either the resin or kerosene emulsion.

In 1896 the State Board of Agriculture of the State of New Jersey voted the sum of 1,000 dollars, and sent Professor J. B. Smith to California to study the habits and report upon this scale.* He found it all over California, but nowhere is it considered an injurious pest, as it is kept in check by natural causes; chief among these in southern California were the "Twice-stabbed ladybird beetle" (*Chilocorus bivulnerus*) and a chalcid parasite (*Aphelinus fuscipennis*). North of San Francisco he found no natural enemies, and though Australian ladybird beetles were said to be destroying the scale, he could find no evidence to support the statements.

Mr. H. Garman during this year has written an account of the spread of this scale in Kentucky.† He states that it attacks all deciduous fruit-trees, spreading over the stems, foliage, and fruit, and remains on the trees all the year round. He gives a general account of the San Jose scale, and the different formulas for the sprays and washes used for its destruction.

Mr. T. D. A. Cockerell has recently published a report‡ entitled "The San Jose Scale, and its nearest allies: a brief consideration of the characters which distinguish these closely-related injurious scale insects." This is a more technical account of the genus *Aspidiotus*, showing the different specific points of each, accompanied with sketches of the anal segment of the species. He also gives a list of the trees and shrubs attacked, furnished by Mr. Howard.

Mr. F. M. Webster, in his "Scale Insects: their habits and distribution, with means of holding them in check,"§ devotes several pages to the San Jose scale. He quotes from records kept at the Department of Agriculture at Washington, the estimate that from the progeny of a single female during a single season 3,216,080,400 individuals can be produced. Thus, though 90 per cent. of the scales may be killed, from those remaining a fresh stock will soon be supplied by the surviving 10 per cent.

* New Jersey Agr. Exp. Station Bulletin 116, 1896.

† Kentucky Agri. Exp. Station Bulletin No. 67, May, 1897.

‡ U.S. Dep. Agriculture, Div. Entomology, Technical Series No. 6, 1897.

§ Indiana Horticultural Report, 1896.

Remedies.

Winter spraying. (1) *Kerosene emulsion.*—Used and found very effective in California:—

> Kerosene, 2 gallons.
> Soap (whale oil)—ordinary yellow soap may be used—½ lb.
> Water, 1 gallon.

Dissolve the soap in the boiling water, add the oil, and mix thoroughly; then add 3 gallons of water to each one of the emulsion, making 12 gallons of spraying mixture; apply warm. Though this spray is found to give very satisfactory results in California, in the eastern States its action is rather uncertain. I have found it very effective as a winter spray, as this scale sticks so tight that it is not injured by an ordinary kerosene emulsion. Trees infested should be sprayed thoroughly twice, at intervals of about a fortnight, and later on towards spring carefully examined to see if there are any living specimens or larvæ in October.

Winter spraying (2). *Lime, salt, and sulphur mixture.*—Used in America and here for scale insects.:—

> Lime, 40 lb., unslacked.
> Sulphur, 20 lb.
> Coarse salt, 15 lb.
> 40 gallons of water.

Take 10 lb. of lime, 20 lb. sulphur, and boil until dissolved in 20 gallons of water; take the remainder of the lime and salt, slake and mix with the boiling mixture; add more water up to 60 gallons, and strain and apply warm. Use gloves to keep the wash off the hands, and thoroughly clean and wash the spray-pump after using this mixture. This is a good winter spray, does not hurt the bark or buds, and can be used for all kinds of scale insect during the winter months. Do not use a copper vessel to boil the mixture in.

Soap wash.—Whale-oil soap and hard soap dissolved in hot water and applied warm:—

> 1½ lb. whale-oil soap.
> ½ lb. ordinary hard soap.
> 1 gallon of water.

The soaps are boiled up in the water. This strong soap wash has been found the most effective remedy used in America applied to an orchard when the peach and apple trees were in bloom; it did not injure either the flowers or leaf. Above 95 per cent. of the scales were found to be dead when examined a few weeks later, while the trees were found next season to be healthy and making a good growth. One application of this wash was found sufficient. The action of this soap wash, when applied in the winter, appears to limit the blooming and fruiting in the following spring, though when applied in the spring it does not seem to affect the flowers or setting of the fruit. However, as a tree badly attacked by San Jose scale will not produce a large crop of fruit, this would not make much difference.

Hydro-cyanic acid gas fumigation.—This is a more elaborate process, but one of the most effective in destroying all kinds of scale insects. When practised in the orchards a drill tent is made, and then coated with linseed oil until it is air-tight, a light derrick is used, and the tent lifted up and hung over the tree, so that the edge all round rests upon the ground; this is either pegged down or the earth thrown upon it to make it completely air-tight. An earthenware dish is placed inside containing water, to which is

added sulphuric acid and cyanide of potassium, and when the last is added the opening closed at once, as the fumes generated are poisonous to all animal life, and must not be inhaled by the operator.

The proportions are as follows :—

1 oz. (by weight) cyanide (58 per cent. pure),
1 oz. (fluid measure) sulphuric acid,
3 oz. ,, water,

to every 150 cubic feet of space enclosed.

Allow half an hour over large trees, and quarter of an hour over small trees.

If all nursery stocks were treated with hydro-cyanic acid gas before they were sent out to the growers there is no doubt that we would be saved a great deal of trouble in the future, and the growers would have some guarantee that the trees they were buying were clean, and not infested with some deadly scale insect.

Howard strongly recommends in all cases of recent or slight attack, that the trees should be rooted up and burnt, and from what I have observed of this scale the same applies to it in Australia, and the first loss is always the best. The scales are so small that though they may be numerous they are passed over unnoticed. The larvæ come out from beneath the parent scale about the middle of October, and may be seen with a lens crawling all over the twigs.

From their very small size they are easily transported about an orchard on the feet of birds, on the backs of other insects; and it is a curious point in regard to this that they always crawl on to a black beetle in preference to any other colour. Thus one of the little ladybird beetles (*Pentilia misella*), which feeds upon this scale, is, unfortunately, just as efficient in carrying them from tree to tree in the American orchards.

The wind is also an important factor in their distribution. I saw an orchard in Maitland where this scale had spread at right angles across the field in a narrow strip, which was in line with the prevailing winds, but was not found on either side.

The following trees* have been recorded as infested, more or less, by San Jose scale, though in Australia apple, pear, peach, plum, and cherry suffer from it most :—

Tiliaceæ, Linden.
Celastrineæ, Euonymus.
Rosaceæ, Almond.
,, Peach.
,, Apricot.
,, Plum.
,, Cherry.
,, Spiræa.
,, Raspberry.
,, Rose.
,, Hawthorn.
,, Cotoneaster.
,, Pear.
,, Apple.
Rosaceæ, Quince.
,, Flowering quince.
Saxifragaceæ, Gooseberry.
,, Currant.
,, Flowering currant.
Ebenaceæ, Persimmon.
Leguminosæ, Acacia.
Urticaceæ, Elm.
,, Osage orange.
Juglandeæ, English walnut.
,, Pecan.
Betulaceæ, Alder.
Salicaceæ, Weeping-willow.
,, Laural-leaved willow.

* List from Messrs. Howard and Marlatt's "San Jose Scale Bull." No. 3, p. 38, 1896.

Mr. Maskell states that he has identified specimens received from Mr. Quinn, of Adelaide, S.A., upon the twigs of a gum-tree (*Eucalyptus corynocalyx*), as this scale, and this is a very remarkable instance of a scale insect attacking such a strange food-plant.*

Legislation against San Jose Scale.

The interests at stake in allowing this scale to get a hold of the country was fully recognised some years ago in the United States, and there can be no question about the need of such legislation wherever this pest makes its appearance.

In the State of Ohio a law has been passed "making the sale, or offering for sale, or allowing this pest to continue on any premises, a misdemeanor, punishable by a fine of not less than 10 dollars, nor more than 100 dollars."

Early this year a Bill, framed by a National Convention (held at Washington, D.C., 5th and 6th March, 1897) of fruit-growers, nurserymen, and station-workers, providing for the inspection of nurseries, was presented to Congress.

Note.

Since writing the above I visited a badly-infested orchard at Berowra, where the scale was thickly covering at least forty peach, apple, and pear trees. Whilst examining an apple-tree I found a number of both the perfect beetle and larvæ of a small black ladybird feeding upon the young scale. This proved to be the *Rhizobius debelis*, Black, an Australian species that was among those introduced into America, and was recently reported to be one of the most useful in destroying this scale in California.

At the same time I found that many of the larger stems were covered with a fine web, and upon removing it exposed a slender caterpillar. A number of these were collected, and within a week, after being fed on San Jose scale, spun elongate, oval, white, silken cocoons upon the foliage; and perfect moths emerged on the 27th November, a fortnight after they were collected. These little moths will be figured and described in a future contribution.

* Trans. New Zealand Institute, vol. xxviii, p. 386, 1896.

Some Notes on Draining.

H. V. JACKSON,
Department of Agriculture.

One of the first matters to be considered in dealing with cultivation is the nature of the material to be dealt with, and it thus becomes necessary to consider what are the main constituent parts of soils generally, and why they are variously designated as calcareous, marly or chalky, clayey or sandy, or as clayey or sandy loam. Briefly stated, all soils are in main composed of sand, clay, and lime, in varied ratios one to the other, and the designation given them depends on the relative position these bear the one to the other. If there is a preponderance of carbonate of lime they are calcareous; if only one-fifth consists of lime they are marly or chalky, and so on. Apart from the ingredients necessary to hold the plant in its place, nature has provided that the plant shall find in the earth the necessary nutriment, without which it could not live.

The presence of useful or harmful ingredients, and the preponderance of one or another of the main general constituents of soils naturally determines whether a soil is adapted to healthy plant-life or otherwise. The constituents of soil, vary not only in quality but in character, and consist of acids forming, with alkaline bases, carbonates, nitrates, sulphates, and phosphates. The varied nature of different soils is governed by the existence of all or some of these, and by the diversified conditions and circumstances under which they are present. The root-fibres of the plants absorb in a soluble condition these components of the soil, and adapt them to the nutriment of the plants by means of structural or "formative cells," minute bodies containing a jelly-like substance called protoplasm. Deeply-cultivated land absorbs the greater part of the water that falls upon it in the shape of rain, consequently there is a naturally-stored quantity of water contained within a given cultivated area of much greater volume than there would have been if the surface had been of a smooth and unbroken character, or hard surface, allowing a considerable amount of water to flow away. The cultivation of the surface soil having therefore enabled the water to sink into the earth a considerable distance, there is naturally a smaller loss by evaporation than there would have been if the moisture was nearer the surface, susceptible to the drying winds and scorching sun-rays. As a consequence, there is the greater food-material for plants in deeply-cultivated ground, for not only is moisture admitted, but the soil is also more subject to the action of the atmosphere, which, however dry, always contains some aqueous vapour, which is also absorbed by the soil and converted into water. Notwithstanding the depth to which water may have permeated the ground, moisture is always rising by capillary attraction, and under such movement is being deposited in more or less quantities about the roots of plants. As it rises, however, it does not come in the same form as when originally deposited, but is charged with all

the materials encountered in its course, in the shape of salts, nitrates, &c., previously mentioned, and now rendered soluble through the action of the water. As the water passes away near the surface in the form of vapour, these salts, &c., are not lost in such vapour, but remain in the soil; therefore, we can understand how water sinking into the soil becomes, through the influence of sunlight and air, the motive power in the transmission of food to plants.

From these simple remarks it will be apparent how much depends upon the proper cultivation of orchard land, or upon any large area devoted to crops.

We hear a good deal at the present time about orchards which have been abandoned, and of similar places that are running to decay, and of the deterioration of orchard products, more especially citrus fruits. Various causes have been assigned for this condition of affairs, amongst others being inexperience on the part of the grower, want of markets, bad seasons, misnamed and poor varieties of fruits, whilst the deterioration of what were once good fruit-bearing orange-trees is very often put down to the extensive use of the lemon stock. All these causes, perhaps, in a measure contribute to the trouble, but the want of proper drainage is probably after all the most important primary cause.

It is generally admitted that all manner of existing things in our climate live more rapidly than in more temperate regions, *i.e.*, there is more waste or exhaustion all round, and this being so, it may be regarded as only natural that some, if not all, fruit-trees sooner or later become impaired, especially those that have been neglected in the matter of cultivation, and have not been supplied with the foods necessary to sustain a healthy growth and life. Consider the circumstances under which oranges in many cases have been grown, crop after crop being taken off the trees season after season, and little or no attempt made to recoup the soil with properties that have been extracted by the trees. Then look at the nature of the soil, in many localities where, unless it be drained and frequently cultivated, it becomes sodden and dank in wet, and hard and unkindly in dry seasons. In connection with the deterioration of orchards, more especially of citrus fruits, the total absence of proper drainage does not in the past appear to have been taken into consideration as a factor exercising a very great and baneful influence.

The plough and the subsoil plough only reach a certain depth, and presuming the subsoil is of a retentive character, though the top soil may be thoroughly cultivated, yet the subsoil remains of a cold and stagnant nature, detrimental to successful plant-growth. Owing to the comparative dryness of our climate some people will contend that it is not necessary to construct drains, asserting all the moisture possible should be retained in the earth; but such folk overlook or forget that proper draining removes only that superabundance of water which would otherwise saturate and sodden the cultivated land, and bring about a sourness through stagnant water accumulating at the roots of the plants. The drains do not drain the land until it has become so overcharged with moisture that it can retain no more. Every variety of soil has its degree of porosity, and the stiffer the soil or subsoil the more essential becomes a proper system of drainage. Not only is the action of the drain of benefit in removing superfluous water, but it tends towards liberating for the use of the roots and making soluble those constituents necessary to plant-life, while the impurities arising from stagnation at the bottom are enabled to gradually pass away. In fact, soil may contain very fair properties for the growing of crops, but it is not until the action of water by means of proper draining below, aided by cultivation above, has

released the soluble substances, that the growing plants are able to make use of Nature's valuable stores. In reference to the idea that in our dry climate, and ofttimes light soils, draining is unnecessary, it will be found that such land can be cultivated deeper, and will retain more moisture to a greater depth after a proper system of drainage than formerly.

The first thing to be done in an area intended to be drained is to take into consideration the configuration of the surface of the ground, ascertaining the lowest point and the general direction and amount of fall of water from the higher portions. Upon the nature of the subsoil will depend the depth to which the drains will require to be dug, and the number and consequent distances apart at which they must be laid.

The drains should be at such a depth that in course of the deepest cultivating the plough and subsoil plough will not reach the drain-pipes; therefore it is always advisable to make drains certainly not shallower than 36 inches. Nearly all authorities agree that drains from 3 feet to 4 feet in depth are required to successfully drain land, and the distance apart at which the drains may be laid depends upon the nature of the subsoils; in stiff, and consequently retentive, ground the drains may be 12 feet to 15 feet apart, but in light and porous subsoils up to 30 feet apart will answer. In moderately stiff ground, 24 feet is a very fair average distance to place the drains apart, but in very stiff material they must, of course, be closer. Before deciding upon the depth and number of drains, it is generally advisable to cut an exploratory drain through the area from the lowest to the highest point.

The point of outfall by means of a main drain will depend upon the configuration and area of the land. If the slope is all in one direction and the area not too great, one main outlet may suffice, but in a larger area, and when the slope is unequal, more than one main outlet may be necessary.

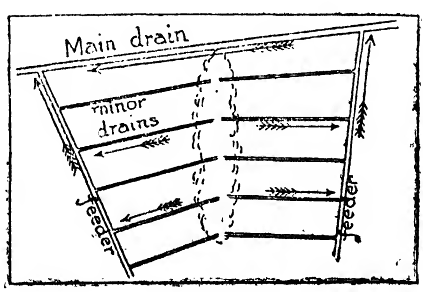


Fig. 1.

The main feeder drains should be laid in a direction most convenient for receiving the minor drains, and in laying these latter they should be laid directly in the direction of the fall of the ground, and not parallel to it or at an angle.

On a piece of undulating country the main drains and feeders must be at the lowest levels.

In particularly level land the slope required will only be arrived at by making the drains shallower at the top end and gradually deepening towards the outfall, and it may be necessary in some cases to have the minor drains laid on to feeders leading to the point of outfall. (Fig. 1.)

The reason for running the drains in the direction of the fall of the hill is that by so doing the drain naturally empties more rapidly, and gathers more water, receiving its supplies from the top, sides, and bottom, while a drain laid at an angle or diagonally across the sloping ground would receive most of its water from the top and upper side. This feature of drain-making must, however, be regulated to some little extent by the nature of the soil and subsoil, and the construction of the drain.

Smooth tile drains are more rapid than rough stone or pole drains, consequently where stone or pole drains are in use, a steeper gradient is advisable. On low-lying land, where the necessary fall is difficult to obtain, long drains are the most effective, as the pressure of the collected or gathering water aids the flow. It is advisable on such level land to use a longer drain than would be necessary on sloping ground, for there is probably a greater body of water on the flat lacking the impetus given to water under other circumstances.

Deep drains carry off a heavy body of surface water more quickly than shallow drains, and their action extends to a greater distance; but in stiff and compact soils depth will not compensate for extending the distance apart. There is a medium in this, as in other affairs.

In wet and low-lying boggy land it is sometimes possible to rid the pasture of superabundant water by means of open drains; in such instances it is a mistake to make the drain square-cut as in Fig. 2. A drain of this nature should always be cut with a batter, *i.e.*, a sloping bank as in Fig. 3.

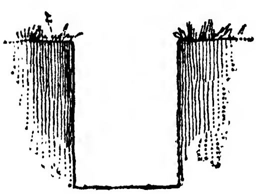


Fig. 2.

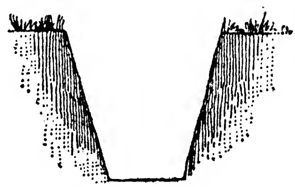


Fig. 3.

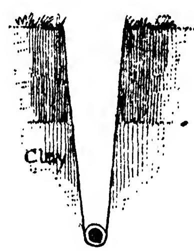


Fig. 4.

In making drains for pipe-laying no more earth should be excavated than is absolutely necessary; therefore the drain is cut as narrow as possible, being of just sufficient width at the bottom to receive the pipe, (Fig. 4.) This is not a difficult matter in ordinary stiff soil or clay, but where stones or roots are abundant it will become necessary to open up a drain in such a manner that the workman can stand in the bottom of the excavation. The drain-cutting should always be commenced from the lower end, so that any water present keeps getting away. Where there is an absence of stones, boulders, or roots, the drain may be opened up with a plough in the first instance, thereby lessening the manual labour in excavating.

The size of drain-pipe to be used is of material consequence, depending upon the length of the drain. In very long drains it is advisable to increase the size of the pipe towards the outfall, say from 2-inch pipe in the upper half of the distance to $2\frac{1}{2}$ and 3 inch in the lower; especially is this arrangement necessary in low-lying level land. The main drains should be in proportion to the united capacity of the minor drains, and the common rule to calculate the ratio of the main drain to the minor drains is to multiply the square root of the number of small pipes by their diameter.

Some idea should always be formed of the work the drains may be expected to perform, so as to, if possible, hit the happy medium in point of size. If the amount of water to be drawn off the land is of limited volume, and consequently the pipe laid is of a small diameter, the pipe should be a well made article and very carefully laid, for every irregularity in the formation of the pipe, or of the laying, will tend to impede the flow of water and contribute to an ultimate clogging of the drain through silt, and a similar result arises if too large a pipe is used, in which, in consequence of the absence of pressure, the water percolates slowly, therefore the pipes that are laid should be just able to carry off the maximum pressure of drainage water.

The first essential preliminary to laying down the drain-pipes is that the cutting for drain be properly graduated, that it be of uniform depth, and the bottom entirely smooth, and having laid the pipes a certain distance, as close as possible at the joints, the pipe-layer should well and firmly set them with a covering of clay to a depth of 4 or 5 inches, so that when the labourer comes along to fill in the whole drain there will not be any possibility of displacement of the drainage pipe.

The setting of the pipes at the joints requires the greatest care, and where the drain is being laid through land of a sandy character, the stiffest material of a clay-like character should be obtained for the purpose of packing, and where sufficiently solid material cannot be obtained then pipes fitted with collars at the joints will be advisable. Great care is also necessary in laying the junction pipes; they should be run in on a curve instead of at direct right angles, and the junction should enter the main pipe low down, level

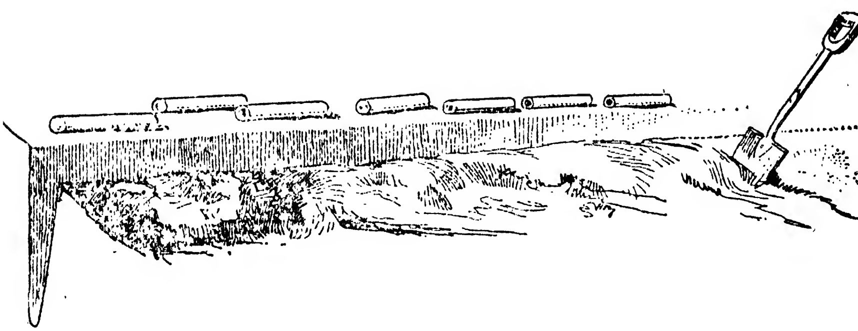


Fig. 5.

with the bottom, thereby ensuring a sweep of water that will clear the drain of any collecting sediment or debris.

The cutting being ready, and the pipes laid along the surface handy for the layer (Fig. 5.), operations begin in the main drain, then the parallel minor drains, always working from the lower levels to the higher; the whole of any drain being laid before any filling in is done, so that in the event of any mishap, or alteration being necessary, it can be done conveniently, and when such drain is duly laid the filling up of the drain is commenced where the laying ended, *i.e.*, at the top end of the cutting. When filling in, the solid clay formation should go back into the bottom of the cutting; the loose and friable material of the top-spit should still be on top upon completion of the work.

The advantages derived from drainage are generally greatest on fairly level land. Where a small hill rises from the plain, a wet swampy place is

occasionally formed at the base, and under such conditions the minor drains should be run at the most suitable angle to feeder drains laid through what appears to be the lowest level of the wet ground to a main drain following the natural fall or outlet.

The main drain and its adjuncts, the minor drains, having been laid, it is advisable to draw a field plan showing the distances at which the drains have

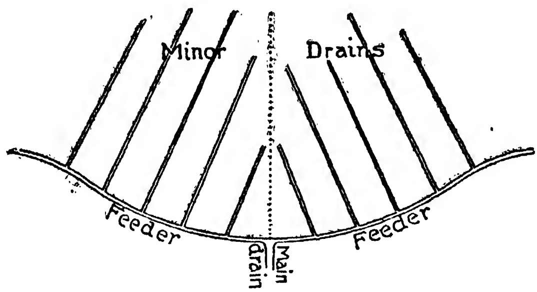


Fig. 6.

been laid apart, stating the length of each drain, the depth to which they are laid, and the direction in which the drain runs, and naming some boundary lines or marks, in the shape of trees, posts, or fences, as "datum points," from which the measurements have been taken. The field plan should be carefully preserved, along with any title deeds, &c., as a work of reference in future years if required for any purpose.

As for the period most suitable for drain-making, that will depend upon the nature of the soil, seasons, and rainfall. In localities where the soil is of a stiff and hard nature the most suitable time will be when there has been sufficient rainfall to make the ground soft and workable, and at a period

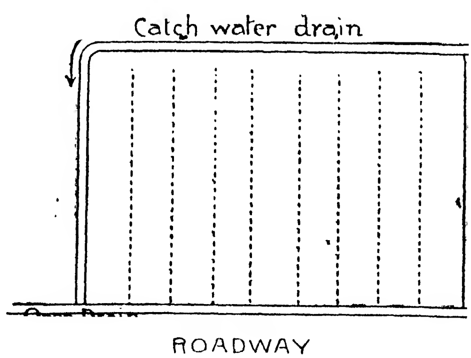


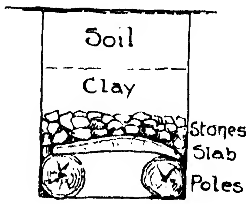
Fig. 7.

when the ground is neither stocked nor cultivated. Very wet lands will, on the other hand, be best dealt with during the dry seasons peculiar to the district, whether it be early, middle, or late summer.

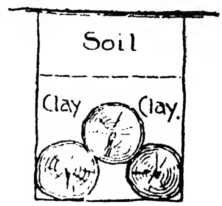
In some cases, of course, the minor drains may empty into a deep open drain along the lower margin of the area, thereby not necessitating the

laying of a feeder-pipe or main. On sloping portions also where there may be rising ground above the drained portion it will be advisable to cut a catch-water drain.

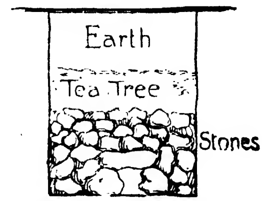
Slab, pole, brush, and stone drains, are made in a variety of ways, of which the illustrations given are sufficiently plain to require little or no explanation:—



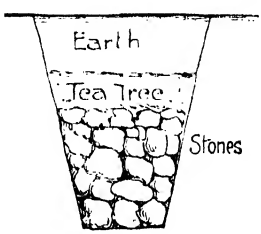
Pole and slab



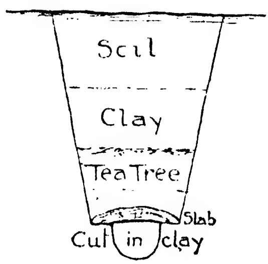
Pole drain.



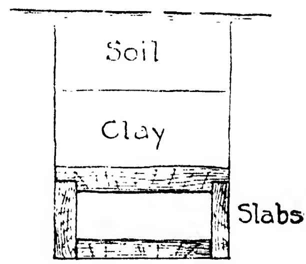
Stone and brush.



Stone and brush.



Clay cut and slab.



Box drain of slabs.

Tile drains are formed by using cylindrical or arched tiles, the latter being used with either separate or attached flat soles. The cylinder pipe-tiles are placed end to end, and are sometimes laid and kept together by means of a collar. Fig. 8.

The cylindrical form is that most commonly in use now, and the collar is not often adopted, excepting, perhaps, where the soil is of a very sandy or porous nature, with an absence of suitable stiffening in the form of clay. Under such circumstances the collar is considered a helping safeguard to prevent the too great ingress of fine sand, which might ultimately choke the

Fig. 8.

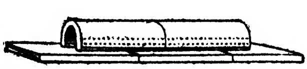


Fig. 9.

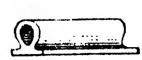


Fig. 10.

drain. The arched tile on loose flat sole when placed in position is so arranged that the joinings of the tiles meet in the centre of the sole. Fig. 9.

The soled tile is made of an oval shape internally, wider above than below, the narrowing of the passage promoting the clearing of sediment. Fig. 10.

The advantage of a soled tile is that it lies firm and even. Besides the solid and even laying of the tiles in the bottom of the cutting a most important matter is the careful and satisfactory joining of all drains at junctions. In laying a main, or feeding, drain which is to receive minor drains from two

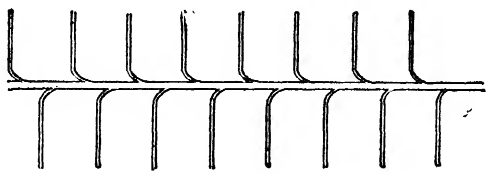


Fig. 11.

sides, it is not a good plan to have the minor drains opposite each other, but they should be run in at alternate distances (say) as in Fig. 11.

And where an outfall or feeder drain is to carry water received from two sides, do not forget that drain has to do double duty in heavy weather, and

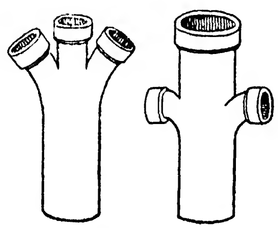


Fig. 12.

must, therefore, be of a size calculated to do the work. If the circumstances are such that it is desired to utilise a junction piece on two sides they are obtainable, made in various patterns, Fig. 12.

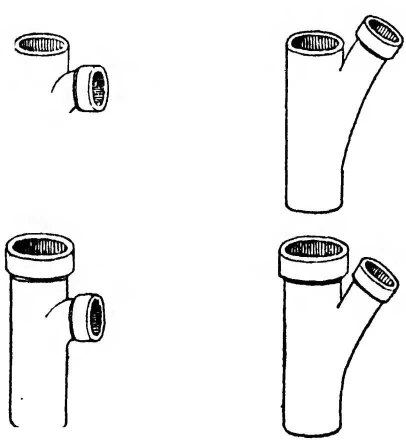


Fig. 13.

After calculating the number of tiles necessary for a given length of outfall drain, the number of junction tiles necessary in the outfall drain will

depend upon the distance apart, and consequent number of minor drains intended to be laid. The junction tiles are simply the ordinary tiles with a hole ready made to receive the smaller size pipe of the minor drain, or they can be obtained with proper flanged inlets at various angles, Fig. 13.

These junctures are much more satisfactory than the ordinary mode of running the small size of pipe into an orifice in a larger tile. The junctures are made to any size required—2 inches off a 3-inch, 3 inches off a 4-inch,

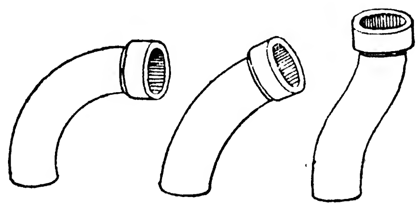


Fig. 14.

or 4 inches off a 6 inch, &c., &c. If a greater sweep is desired than that obtainable by running the minor drain direct to the junction inlet, bent pieces are manufactured to any curve desired, Fig. 14.

Bends and junctions can be obtained made with inspection hole, thereby affording an opportunity to examine and clean away, if necessary, any collected debris at such places without opening up a long length of drain, or disturbing unnecessarily a number of drain tiles, Fig. 15.

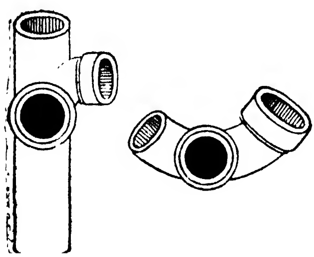


Fig. 15.

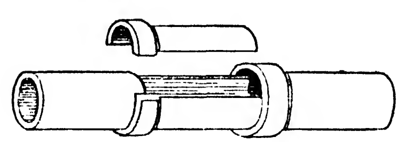


Fig. 16.

Drain inspection pipes are also manufactured, on the principle illustrated in Fig. 16.

Drain tiles are usually made 1 foot long, and can be obtained from 1½-inch and 2-inch bore up to the size of ordinary large sewer pipes.

A good drain tile is smooth within, is well-burned, and should ring when struck. It should show a clean and uniform fracture, and be capable of standing sudden changes of temperature without cracking. In the latter respect they may be tested by plunging alternately into hot and cold water. In their manufacture the clay should be fairly pure, containing no lime nor coarse grains of sand. Well-burned tiles, at depths of 3½ to 4½ feet, should last twenty-five years.

The Sydney prices average something as under:—

12 x 1½	inch bore,	about	35s. per 1,000 feet.	
12 x 2	„	„	40s.	„
12 x 3	„	„	80s.	„
12 x 4	„	„	16s. per 100 feet.	
12 x 6	„	„	25s.	„

Junctions and bends are usually sold at an advance of, say, 50 per cent. on the price of the drain-pipe, *i.e.*, single junction, 2 feet long, is charged as 3 feet of pipe.

The following gives the number of rods and the number of pipes per acre, with drains at various distances apart:—

Distance between drains. Feet.	Rods per acre.	12-inch pipes.
15	176	2,904
18	146	2,420
21	125	2,074
24	110	1,815
27	97	1,613
30	88	1,452

The tools required for drain-making are few. After having marked out the line of drain, the top spit is removed by means of a common garden

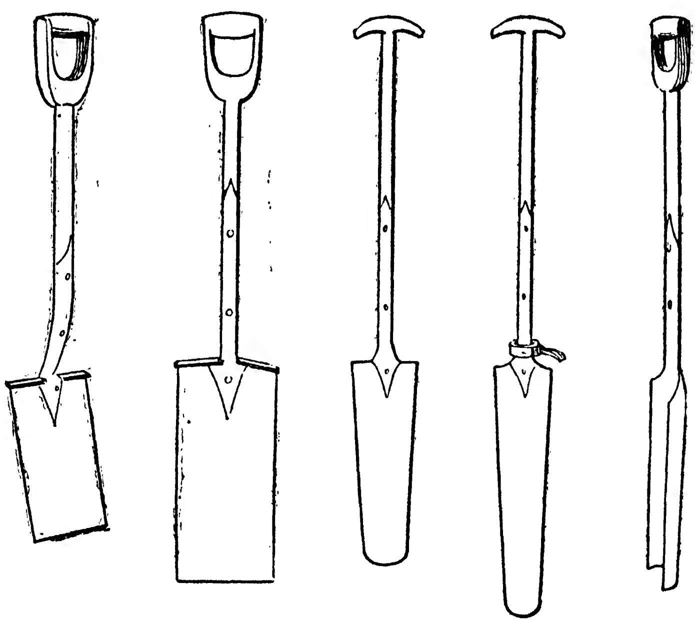


Fig. 17. Fig. 18. Fig. 19. Fig. 20. Fig. 21.

spade (fig. 17). A long-bladed spade for deep, narrow spits is shown in (fig. 18). The middle and bottom spit is removed by using long, half-round spades

(figs. 19 and 20). Fig. 21 represents the bottoming spade, so called. The loose earth is removed by using scoops of sizes corresponding to the half-

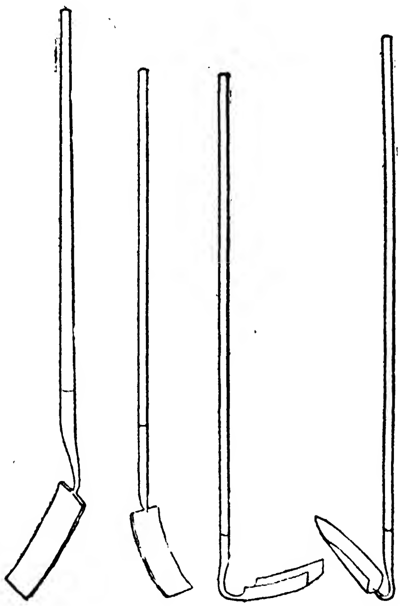


Fig. 22.

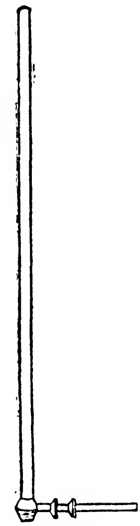


Fig. 23.

round spades in use (fig. 22). Figure 23 represents an ordinary pipe-layer. In stony or otherwise hard ground picks are necessary (fig. 24).

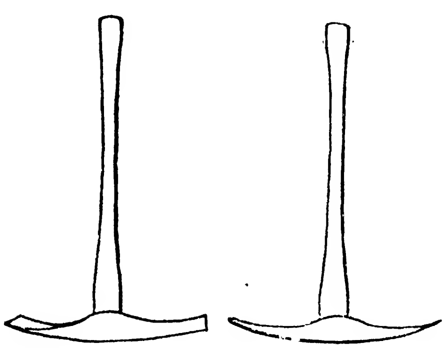


Fig. 24.

Figure 25 is another device whereby a number of pipes may be run on to a light, smooth stick, and so laid in position at the bottom of the drain. The

pipes are packed, joining with a first spit of clay before removing the laying-rod, which is done by carefully pulling back the rod, by means of a stout

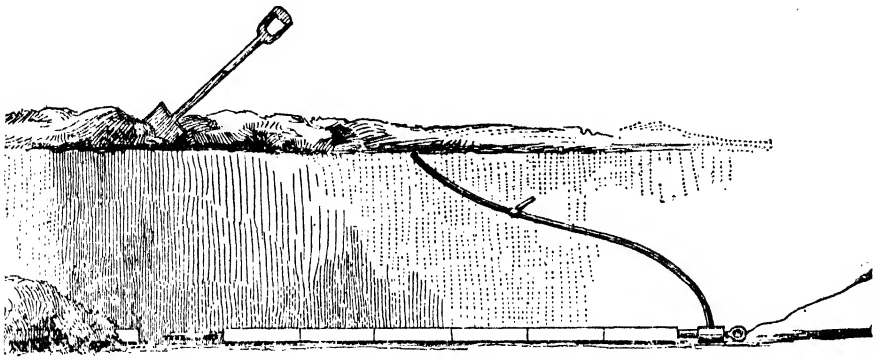


Fig. 25.

string, in such a manner that the rod is withdrawn on the straight, *i.e.*, without uplifting.

As farmers and others may find some particulars of land-measurement of much use to them, the following are given for ordinary purposes :—

A TABLE for reducing Acres, Roods, and Perches into Square Links.

Acres.	Square Links.	Perches.	Square Links.	Perches.	Square Links.
1	100,000	1	625	21	13,125
2	200,000	2	1,250	22	13,750
3	300,000	3	1,875	23	14,375
4	400,000	4	2,500	24	15,000
5	500,000	5	3,125	25	15,625
6	600,000	6	3,750	26	16,250
7	700,000	7	4,375	27	16,875
8	800,000	8	5,000	28	17,500
9	900,000	9	5,625	29	18,125
10	1,000,000	10	6,250	30	18,750
20	2,000,000	11	6,875	31	19,375
30	3,000,000	12	7,500	32	20,000
40	4,000,000	13	8,125	33	20,625
50	5,000,000	14	8,750	34	21,250
60	6,000,000	15	9,375	35	21,875
70	7,000,000	16	10,000	36	22,500
80	8,000,000	17	10,625	37	23,125
90	9,000,000	18	11,250	38	23,750
100	10,000,000	19	11,875	39	24,375
		20	12,500		
Roods.	Square Links.				
1	25,000				
2	50,000				
3	75,000				

Lengths of Sides of Square portions of certain areas.

Acres.	Sides.		Acres.	Sides.	
	chains	links		chains	links
1	3	17	20	14	15
2	4	48	30	17	33
3	5	48	40	20	00
4	6	33	50	22	37
5	7	08	60	24	50
6	7	75	70	26	46
7	8	37	80	28	29
8	8	95	90	30	00
9	9	49	100	31	63
10	10	00			

One mile is 80 chains. 640 acres, 1 square mile.

In measuring an acre by yards, the usual practice is to trace off 70 yards in length and 70 yards in width. This in a rough way may be considered near enough for practical purposes, but as 70 yards either way make 4,900 square yards, it exceeds 1 acre by 60 yards.

To measure an accurate acre, it may be measured 70 yards in length by 69$\frac{1}{7}$ yards in width, the same result may be arrived at by measuring 220 feet in length, and 198 feet in width, or by measuring 73$\frac{1}{3}$ yards in length by 66 yards in breadth.

An acre of ground comprised within four equal sides measures 208·71 feet each way.

Half an acre of ground comprised within four equal sides measures 147·581 feet each way.

A circular acre is 235·504 feet in diameter.

A circular half acre is 166·52 feet in diameter.

Green Manuring.*

In the seventh series of his *Etudes Agronomiques*, M. Grandeau, the Inspector-General of the French Agricultural Experiment Stations, publishes some interesting notes concerning the important functions of leguminous plants in the fixation of nitrogen. After alluding to the discoveries made by M. Pasteur, who demonstrated the incessant and colossal action of bacteria, which had hitherto been ascribed to chemical agency, M. Grandeau briefly describes the character of the investigations undertaken by Hellriegel and Wilfarth, whose labours were suggested and influenced by the work of Pasteur.

Hellriegel for some years cultivated various cereal and leguminous crops in sterilised soil, and added their necessary alimentation in the shape of nutritive solutions of phosphoric acid, potash, and nitrates. In the case of the cereals the resulting crop was distinctly in proportion to the quantity of ammonia placed at its disposition, and in no case did the cereals develop when supplied with nutritive solution in which nitrogen was absent. On the other hand, the leguminous plants differed extremely in their growth. In some pots the plants flourished, in others they barely existed, though the conditions were exactly similar. Upon examination, it was found that in the former case there were numerous nodules composed of micro-organisms upon the roots, while in the case of the weakly plants the nodules were absent. In 1886, Hellriegel, after a long series of experiments, announced to the scientific world the fact of the fixation of nitrogen by the bacteria of the nodules on the roots of leguminous plants, and he held that this was the source whence these plants drew their supply of nitrogen.

M. Grandeau goes on to give an account of the nodules of leguminous plants, and of the bacteria within them. It had been shown that plants of this kind could not exist in sterilised soil, and absolutely cut off from nitrogen; and, from experiments made by Dr. Nobbe, it was ascertained that the bacteria in the nodules of different species of leguminous plants differ essentially in their physiological properties, in that they form nodules easily on the roots of plants of the same species as those from which they originated, while they have not nearly so much influence upon allied species, and hardly any influence on the roots of leguminous plants of a widely-removed species.

Further knowledge is required as to the degree in which the bacteria of species of leguminous plants, more or less closely allied, are active in respect of the different species of the same family, and it is especially important to have more precise information on this point, as M. Grandeau remarks that henceforth inoculation by means of soil containing bacteria should be adopted

* From the Journal of the Board of Agriculture, London.

in the culture of leguminous plants; but this factor, in the opinion of Dr. Nobbe, does not yield in importance to the proper selection of mineral manures.

From the fact that leguminous plants obtain from the air, an inexhaustible and gratuitous source, the nitrogen necessary for their development, they occupy an increasingly important position among cultivated crops. Varying with the species cultivated, the nature of the soil, and the climatic conditions of the season, a crop of leguminous plants fixes considerable but different quantities of nitrogen obtained from the atmosphere. These quantities vary from 53 lb. to 134 lb. per acre. If a leguminous crop is dug in green, the amount of nitrogen resulting from it, according to M. Grandeau, is equivalent to a good dressing of nitrogenous manure—nitrate of soda, sulphate of ammonia, or farm-yard manure. If the foliage of the plants is utilised for cattle, the stems and roots remaining in the ground contain enough nitrogen to ensure a full yield of cereals or other plants.

An interesting account is given by M. Grandeau of the results of the inoculation of soil with bacteria adapted to the different leguminous plants, which, he shows, may increase enormously the assimilating power of these plants. Inoculation is accomplished by broad-casting on the land to be planted varying quantities of finely comminuted earth taken from a field which has borne a crop of the same species of leguminous plant which it is intended to cultivate. Among numerous experiments in this direction, M. Grandeau cites some made by Professor Frühweh at Mædling with yellow lupins, serradella, *Ornithopus sativus*, and *Lathyrus silvestris*, in calcareous soil. Of two plots of land planted with serradella, one was treated with a small quantity of earth impregnated with bacteria from previous cultures, and the other was not so treated. On the 9th of August it was found that the crop on the plot that had been inoculated was more than three times the weight of that on the plot not inoculated. In the former case the roots of the serradella were covered with nodules, in the latter case they were absolutely wanting.

The land on which the lupins were grown was inoculated with earth from soil that had previously borne lupins. On one plot the quantity of impregnated earth equalled about 8 cwt. per acre, and on another 16 cwt. per acre; the third plot was not inoculated. The plants on the first plot reached an average height of $15\frac{3}{4}$ inches, and the weight of the crop on this plot was double that on the plot not inoculated. The crop on the second plot was more than one-third larger than that on the first plot, and three times larger than that on the plot not inoculated. Inoculation had apparently doubled and trebled the crops according to the quantity of bacteria-infected earth supplied. M. Grandeau states that the result of the experiments on two other beds equally demonstrated the advantage of inoculation.

In some other experiments the quantities of bacteria-infected earth applied ranged from half a ton up to $1\frac{1}{2}$ tons per acre, and the results were equally marked; but, as M. Grandeau admits, there are many questions as to the influence of the inherent fertilising qualities of different soils, as to the effect of this or that leguminous plant, and as to the quantities of earth to be employed for purposes of inoculation, which require continued investigation. Nevertheless the value of the process seems to be sufficiently established, and it may be adopted by practical men, especially as it involves but slight expense, and its results promise to be most advantageous to agriculturists.

Experiments can be made in two ways:—1st, by broadcasting some hundredweights of earth taken from land that has yielded a good leguminous

crop, upon the field which is to be sown with leguminous plants. 2nd, by watering the field with water which has been in contact with earth from land which has yielded a good leguminous crop.

There is yet a third method of inoculation, namely, by means of the preparation known as "Nitragin,"* to which M. Grandeau does not allude in the *Etudes Agronomiques*. This, however, appears to be even more simple and economical than either of the methods described by him, and it only remains to ascertain its actual value from the results of various experiments which are being conducted by scientific agriculturists in this country, and by investigators and cultivators in Germany. "Nitragin" is the pure culture of the nodular organisms found on the roots of leguminous plants; the method of obtaining these was discovered by Dr. Nobbe, of Tharand, in Saxony. The culture is placed in a bottle containing a nutrient solution, as agar gelatine, upon which it grows, and the bottle is hermetically sealed and kept from the light. "Nitragin" can be obtained in this condensed bottled form, derived from the nodules of several species of clover, lupins, beans and peas, tares, lucerne, sainfoin, and other leguminous plants, and suitable for application in order to promote and stimulate the growth of crops of the same species as that from which it was evolved. If this new and direct mode of inoculation should prove satisfactory, it will be a distinct advantage over the methods described by M. Grandeau, as the application is simple and inexpensive, and the inoculation of each kind of leguminous plant with its own peculiar organism can be easily ensured.

In connection with the various methods that have been described for the purpose of supplying nitrogen to leguminous plants by means of their specific organisms, it must be borne in mind that these processes will not produce satisfactory results unless there is a proper supply of organic and mineral manures, as potash, lime, and phosphoric acid, in the soils on which the crops are cultivated.

M. Grandeau has a long chapter showing how the power of assimilation and fixation of nitrogen has been most extensively and beneficially utilised in Germany by M. Schultz, who has made sterile land fertile, and turned a waste into fruitful fields, by a system of green manuring (*engrais verts*)—ploughing in leguminous plants of several kinds, but mainly lupins. M. Schultz's experiments were made at Lupitz, in Saxony, upon light sandy soil, which naturally only yields a crop when plenty of manure is supplied, and then the produce barely covers the outlay. In rainy seasons M. Schultz noticed that this poor land produced luxuriant growths of yellow, white, and blue lupins, and it occurred to him that it might also be possible to make it yield other crops suited for the food of man. After forty years of continuous experiments he has formulated a system of cultivation which has completely transformed land, considered *quasi* barren in 1855, into fertile soil, growing remunerative crops.

The basis of this transformation is the cultivation of leguminous plants, notably lupins, in alternation with cereals, potatoes, and other crops, and the rational use of mineral manures—lime, potash, and phosphoric acid—but without any direct application of nitrogenous manures. This system has answered so well that intermediate cropping with leguminous plants has now extended over the whole of M. Schultz's estate of 600 acres. This system is known throughout Germany as the Lupitz method of manuring by the ploughing in of intermediate crops of leguminous plants, which not only

* An article by Mr. F. B. Guthrie on this subject appeared in the *Agricultural Gazette*, p. 690, Vol. VII (1896).

cause the fixation and accumulation of nitrogen in the soil, but supply the soil with mineral constituents, and at the same time, by the very deep penetration of the roots of the plants, especially lupins, into the subsoil, enable the roots of succeeding crops to go deep down in search of food.

At a Conference held in Dresden in 1891 M. Schultz summed up the results of his experiments succinctly in the following terms:—"With a limited stock of fatting cattle, without buying any nitrogenous manures, by adding potash, phosphoric acid, and lime, I have succeeded in fixing, at the expense of the atmosphere, a considerable quantity of nitrogen, by which I have been enabled to diminish by 50 per cent. the expense of the production of cereals grown at Lupitz, or, which comes to the same thing, to raise the average profit to 30s. per acre, notwithstanding the unfavourable state of the markets."

Details are given by M. Grandeau of M. Schultz's experiments with no less than thirty species of leguminous plants, with the object of discovering the most suitable for his purpose. Among these were *Lathyrus clymenum*, peas, white, blue, and yellow lupins, mixed, in some cases, with other plants, as rape, mustard, and winter turnips. These being cut when in flower—the flowering period or soon after being the proper time for ploughing in the green manure—were severally analysed.

Taking together the leaves and roots of six different leguminous plants, the results of the analysis are given below:—

Name of Plant.	Dry Substance per Acre.	Fixed Nitrogen per Acre.	Equal to Nitrate of Soda per Acre.
	lb.	lb.	lb.
Lathyrus clymenum	5,100	154	1,000
Peas	7,140	198	1,267
Mixed leguminous plants	5,998	165	1,028
Lupins, white	6,273	162	1,039
Lupins, blue...	7,020	171	1,081
Lupins, yellow	5,090	130	847

This table shows that the crop of peas ploughed in was equal in manurial value to more than half a ton of nitrate of soda per acre, and was in this respect much superior to all the other crops. Blue lupins gave the next best return, as represented by an equivalent of value in nitrate of soda; but it must be noted that in the case of the peas the amount of dry substance required to yield the equivalent of 1,267 lb. of nitrate of soda, or 7,140 lb., was proportionately less than in the blue lupins, whose equivalent value in the form of nitrate of soda was 1,081 lb., from 7,020 lb. of dry substance. M. Grandeau states that another great advantage of this system of green manuring is that the nitrogen supply is gradually evolved as the buried substance decays, and is, therefore, available for the use of the crop throughout its growth.

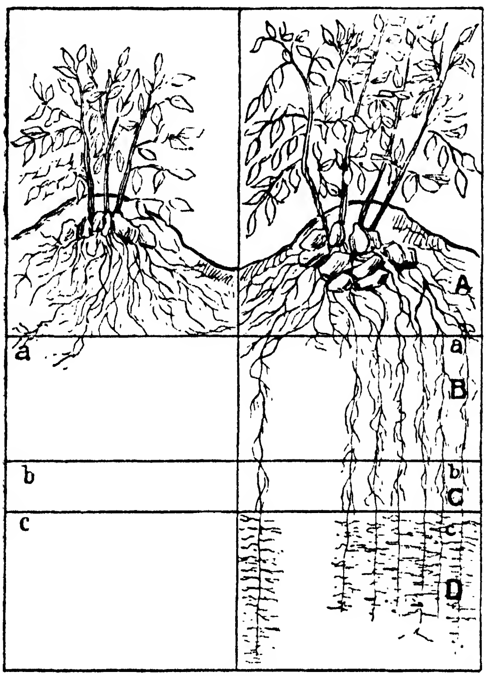
Allusion has been made to the mechanical action upon the soil of the roots of leguminous plants, which, as M. Grandeau puts it, exercise a considerable influence upon the fertility of land. This was not realised in any way until the important experiments at Lupitz had proved it in a striking manner. From these experiments it appears that when rye succeeded a crop of lupins its roots penetrated over 3 feet into the earth, and the roots of potatoes descended still deeper; but upon land adjoining, manured with

farmyard manure, and not having had a previous crop of lupins, the roots of rye descended only between 16 and 24 inches.

The results of experiments in this direction are graphically shown by the accompanying figure.

This figure is reproduced from a photograph of deep sections of two fields together, 37 acres in extent, cultivated for the potato crop with and without green manuring.

The letters A, B, C, D, denote the nature of the strata of soil and subsoil of field 1 through which the roots of the lupins of the previous crop had made channels, and facilitated the passage of the roots of the potato plants. Following these channels, the roots of the potato plants got into D, which, on account of its depth, had retained moisture. This caused them to spread laterally in an extraordinary manner, as shown in the figure, and the potato plants were thus supplied with water, thereby assuring the success of the crop, which equalled 9 tons per acre of well shaped, good cooking, potatoes. The yield of field 2, which had not been green manured, was only 6 tons per acre. The tubers contained more starch than those from field 1, but they were less shapely and not so good for cooking. The cost of manuring field 1 was about 19s. per acre; that of field 2 was close upon £3 12s. per acre.



Field 2. Field 1.

Experiments with rye gave similar results. After lupins the rye plants attained heights ranging between 47 and 67 inches, the roots were 45 inches long, and the yield per acre was about 14 cwt. of grain. Rye grown after potatoes only attained the height of from 27½ to 38 inches, the length of their roots varied from 20 to 24 inches. The crop was only equal to 6½ cwt. of grain per acre.

Of the various leguminous plants tried by M. Schultz, the roots of the blue lupins penetrated most deeply into the soil. The white lupin came next in this respect, and slightly surpassed the blue lupin in the fixation of nitrogen. The yellow lupin was not quite so good as the other species of lupin, while peas, though they exceeded the lupins in the fixation of nitrogen,

did not penetrate the soil with their roots more than from 9¾ to 12 inches. The different varieties of *Lathyrus* came next in value, and though they were not equal to lupins they might be used instead of them. M. Grandeau is himself experimenting with regard to green manuring in France, and the results of his experiments will be looked for with much interest.

Records of experiments upon several Norwegian farms with lupins and other nitrogen-assimilating plants have been recently published by Dr. Larsen. The principal subjects of experiment were crops of potatoes and oats taken after lupins ploughed in green in some cases, and in other cases harvested. The soil was of a poor sandy nature, and superphosphate, basic slag, and nitrate of potash were applied. In most cases the whole crop of lupins was ploughed under, but in one case it was harvested, and only the stubble and roots ploughed under. The results were not so satisfactory as in M. Schultz's experiments, and indicate that the crop of lupins ploughed under was not able to supply sufficient nitrogen for the potato crop, as on several trial plots an increased amount of nitrate of potash added to the yield of potatoes.

Inoculation, or infection, was also tried by applying to each acre of the land to be sown with lupins from 132 to 396 bushels of soil which had borne a crop of lupins. From these experiments it is considered by Dr. Larsen that 264 bushels per acre of lupin-infected soil is sufficient to obtain a good return of lupins, and that 132 bushels will often prove sufficient. It will be noticed that this amount of lupin-infected soil is enormously in excess of the quantity used by M. Schultz, and would render the operation far more tedious and costly. It seems to indicate that in Dr. Larsen's experiments the land was not so thoroughly infected with lupin-bacteria as in the trials at Lupitz by long-continued lupin cultivation. The conclusions at which Dr. Larsen arrives are that infection with lupin bacteria does not help the growth of other leguminous plants, but that on the other hand, lupin-bacteria, or soil infected with lupin-bacteria, added considerably to the yield of lupins, which appears to prove that each leguminous plant requires its peculiar or symbitic bacteria to influence its growth.

Dr. Dehlinger carried on experiments near Darmstadt in 1891 with green manuring upon soil of quite a different character from that employed at Lupitz or in Dr. Larsen's experiments in Norway, some of it being loamy, and some loamy with a mixture of sand, having considerable natural fertility. Upon taking this land in hand, Dr. Dehlingher got rid of the live-stock, and instead of farmyard manure adopted "green manuring" with most satisfactory results, obtaining good crops at a greatly diminished cost.

There have been other experiments in Germany under the superintendence of Dr. Salfeld, and in Sweden directed by Dr. Von Feilitzen, of a more or less successful character, and others are now in progress, which it is hoped will lead to more definite knowledge upon a subject so important to agriculturists.

Imports of Dairy Produce into the United Kingdom.*

OUR aggregate imports of all kinds of dairy produce in the past year were valued at nearly £24,000,000, including £15,344,000 for butter, £2,500,000 for margarine, £4,900,000 for cheese, and £1,178,000 for condensed and fresh milk and cream. Twenty years ago the value of our receipts of these products, omitting milk and cream, amounted in the twelve months to about £13,956,000, of which £9,718,000 was for butter and butterine, and £4,238,000 for cheese. Thus, between 1876 and 1896, the estimated expenditure of the United Kingdom in the purchase of manufactured products of foreign and colonial dairies, and of margarine, has increased by about £10,000,000. During the same interval, the aggregate annual importation of these articles has nearly doubled, viz., from 3,191,000 cwt. to over 6,208,000 cwt. the greater part of the difference having been credited to butter and margarine, the entries of which have risen from 1,659,000 cwt. to 3,900,000 cwt. whereas those of cheese have risen from 1,531,000 cwt. to 2,245,000 cwt. In other words, the volume of foreign and colonial milk imported into this country in the form of butter, cheese, and margarine (reckoning a pound of margarine as being equivalent to a pound of butter) has expanded from 682,000,000 of gallons in the earlier year mentioned to 1,453,000 of gallons in 1896. If these figures are applied to the declared values of the articles concerned, it would appear that the milk received last year in the form of butter was valued at nearly 4d. per gallon, while that received in the shape of cheese was of the estimated value of nearly 4¾d. per gallon.

Hitherto we have been dealing with the gross imports, and although the exportation of dairy produce from our shores is of comparatively insignificant dimensions, a more accurate appreciation of the extent of the consumption in this country of foreign and colonial milk products and of margarine will be obtained by a comparison of the net receipts of these articles with the estimated population. The following statement shows the quantities of imported butter, cheese, and margarine retained for food annually at intervals of five years since 1876 :—

Year.	Butter.	Margarine.	Cheese.
	Cwt.	Cwt.	Cwt.
1876	1,636,000	†	1,486,000
1881	1,983,000	†	1,800,000
1886	1,481,000	870,000	1,685,000
1891	2,071,000	1,225,000	1,976,000
1896	2,980,000	914,000	2,192,000

* Reprinted from the Journal of the Board of Agriculture, London).

† Included with butter.

If butter and margarine are taken together, a calculation based on the above figures show that the supply of these articles available for consumption has increased from 5·5 lb. per head in the earliest year to 11·1 lb. per head last year. Foreign and Colonial cheese has not met with a corresponding demand, for the net imports per head have increased by only one-fifth, viz., from 5 lb. to 6·2 lb. per head. Prior to 1886 the entries of margarine were not separately distinguished; between that year and 1892 the net quantities entered rose from 2·7 lb. to 3·7 lb. per head of the population, but they have since steadily diminished, and amounted to only 2·6 lb. per head in 1896. Butter, on the other hand, has reached our ports in annually-increasing consignments, the net imports during the past decade having risen from $4\frac{1}{2}$ lb. to $8\frac{1}{2}$ lb. per head.

From the above figures some idea may be obtained as to the number of cows which would be required to furnish the supply of imported butter and cheese. Our aggregate net imports of these two articles last year amounted in milk to about 1,157 million gallons, and this would represent in this country, the produce of 2,892,500 cows, assuming that the yield of milk from an average cow, allowing for differences in the period of lactation, amounts to about 400 gallons per annum. At the same rate of production the total yield of milk from the dairy herds of the United Kingdom in 1896 works out to nearly 1,600 million gallons.* Thus, excluding the imports of margarine and of fresh and condensed milk, the volume of milk in all forms available for consumption in the past year amounted, on the basis of the calculation already adopted, to about 2,700 million gallons, and to produce the whole of this supply a milking herd of nearly 7,000,000 cows would be required.

In 1886, the year when butter was first separately distinguished in the Trade Returns, Denmark and France each contributed about 26 per cent. of the entire importation, but while the supply from the former country now constitutes over 40 per cent. of the total quantity entered annually, the consignments from French dairies have fallen to about 15 per cent. Butter has also been shipped to this country in considerable quantities from Holland; these shipments declined with the growth of the Dutch margarine trade, but there has been a recovery in recent years, and they now form about 8 per cent. of the yearly importation. Swedish producers contribute about 11 per cent. of our present annual imports, and a similar proportion was received from Australasia in 1895. The average value of the butter imported from all sources last year was £5 1s. per cwt., or nearly 11d. per lb.

The bulk of the importation of cheese is supplied by Canada and the United States. Until 1891 the latter country contributed the major portion of the transatlantic supply, but during the past few years our annual consignments from the Dominion have been about twice as heavy as those from her southern neighbour. In 1876 the entries of Canadian cheese amounted to about a quarter of a million cwt.; last year they exceeded this quantity by nearly a million cwt. During the same period our receipts of cheese from the United States have fallen from about one million cwt. to nearly half this quantity. Dutch cheese, which formed about one-fifth of the total importation in the earlier year mentioned, is also relatively in smaller demand in this country than was formerly the case, as the imports of this variety now

* There are no official data as to the production of milk in the United Kingdom. The estimate adopted above is probably in excess of the actual quantity yielded, as an allowance must be made for a certain percentage of non-productive cows. The number of cows and heifers in milk or in calf in the United Kingdom is 3,959,087.

constitute about one-eighth of the entire annual receipts. The average value of the cheese imported from all sources in 1896 was 43s. 8d. per cwt.; that from the United States was valued at 42s. 6d., and Canadian at 42s. per cwt.

Nearly the whole of the foreign margarine consumed in the United Kingdom is made in Holland, the Dutch manufacturers having enjoyed practically a monopoly of the trade with this country during the past decade, but the quantity imported has declined since 1892. The average value of this product in 1896 was nearly 54s. per cwt.

Fresh milk and cream were imported in comparatively large quantities in 1894 and 1895; but this trade, which attracted some attention at that time, shows few signs of becoming permanent. In 1894 the quantity imported was 161,600 gallons, in the following year there was a total importation of 127,000 gallons, and last year the receipts amounted to only 22,776 gallons. The bulk of our supply of foreign milk and cream has been furnished hitherto by Holland and Sweden, the latter country having contributed the greater quantity. Condensed milk was first distinguished in trade returns in 1888, and the imports have increased annually from 352,000 cwt., of the value of £735,000, to 611,685 cwt., of the value of £1,172,000 last year.

We may now proceed to review briefly the principal features of dairy-farming in the several countries which contribute to the imports of manufactured milk products. Among our foreign and colonial purveyors of butter Denmark occupies the premier position, and her share of this trade has been steadily growing during the past ten years. In the same period the stock of cows on Danish farms has increased from about 900,000 to over 1,011,000, so that it now numbers about 450 per 1,000 of the population of the country. (In the United Kingdom the estimated number of cows and heifers in milk or in calf represents about 100 per 1,000 of the population.) The cultivated area of Denmark, according to the latest official returns, is 7,062,000 acres, of which 3,029,000 acres are under corn crops, 3,082,000 acres under permanent and rotation grasses, 130,000 acres under roots, and 129,000 acres under potatoes, and 47,000 acres under spurrey. The Danish agricultural statistics for the past twenty years show that there has been a large extension of the arable acreage under fodder crops and of that under spurrey and roots; but the remarkable development of the dairying industry, and, in a lesser degree, of pig-keeping, has created a greater demand for natural and artificial feeding stuffs than could be satisfied by the productive capabilities of the country, and there is consequently a considerable importation of oil-cake and bran.

In 1895-96 the net exports of butter from Denmark amounted to 99,000,000 lb., this being 72,000,000 lb. in excess of the quantity exported eleven years ago.* The great extension of dairying indicated by these figures has been closely connected with the growth of the co-operative movement among dairy-farmers. It is estimated that there are now 1,000 associations of Danish farmers engaged in the manufacture of butter, principally for the British market. A full account of the system upon which the co-operative dairies are worked has already been published by the Board of Agriculture,

* The net export of butter in each year since 1884-85 have been as under:—

	lb.		lb.
1884-85	27,242,000	1890-91	77,610,000
1885-86	35,457,000	1891-92	75,960,000
1886-87	38,593,000	1892-93	78,956,000
1887-88	51,950,000	1893-94	91,028,000
1888-89	56,885,000	1894-95	87,995,000
1889-90	72,048,000	1895-96	99,294,000

and it may be sufficient to state here briefly that these establishments are, as a rule, erected by co-operative associations of farmers keeping cows, the necessary capital for the initial outlay being usually borrowed on the joint security of the members. When the building debt incurred by a society has been extinguished, the assets are apportioned as shares among the members in the proportion to the quantity of milk delivered by each. The whole of the milk produced on the farm of each member, with the exception of the small quantity required for the household, is consigned to the dairy of the society to be made into butter, the milk being separated by the centrifugal process. The milk is paid for periodically, and at the end of the year the surplus profits, after the payment of 5 per cent. on the shares, are divided in proportion to the quantity of milk delivered by each member during the twelve months. Members are generally required to take back the separated milk and butter milk at a price fixed by the association.

It is contended that the adoption of the co-operative system has enabled Danish farmers to produce a butter of uniform texture and quality, and that it has largely reduced the cost of production. In this connection reference may be made to some interesting examples of the balance-sheets of Danish dairies, contained in the *Tidskrift for Landokonomi*. In one of these, which relates to a large co-operative dairy in Jutland, the actual working expenses for the twelve months ended October, 1896, calculated upon 100 gallons of milk, amounted to 4s., the sum paid to shareholders for the milk supplied during the year was 33s. 9d., and the receipts from sales of butter, cheese, and bye-products amounted to 44s. 2d., so that the return to the shareholders for every 100 gallons of milk was 40s. 2d., or about 5d. per gallon.* The balance-sheets of another co-operative dairy in the island of Fünen for the same year show a net return to the shareholders of just under 5d. per gallon.

Co-operation has been applied with success to many branches of agriculture in France; but co-operative dairies in that country were practically unknown until quite recent years, and their number did not exceed 100 at the end of 1895. These establishments are, however, principally engaged in the home trade, the greater part of the French butter produced in Normandy and Brittany for export being prepared in what are known as blending factories, which are owned mainly by the large export houses. In these factories the butter collected from the farmers in the neighbourhood is graded and mixed by machinery in order to obtain a product of uniform colour and quality.†

* The loan incurred by the association for the erection of the dairy buildings has been paid off. The accounts for the year are shown as follows:—

Receipts.		Expenditure.	
	£		£
Sale of butter	7,994	Milk (473,000 galls.)	7,980
Sale of cheese	592	Wages, £198; cartage, £254 ..	452
Sale of milk and cream ..	24	Coal, ice, salt, colouring matter, &c.	127
Receipts from skim milk and butter milk sold to members	1,796	Appliances and repairs.. ..	299
Other receipts	42	Interest	51
		Other expenses	15
		Profit	1,524
Total	£10,448	Total	£10,448

† A full description of the methods of mixing followed in Normandy will be published in our next issue.—Ed. *Agricultural Gazette.*

According to a recent estimate of the French Minister of Agriculture, the number of cows in the Republic is 6,360,000, and the annual production of milk is about 1,716,000 gallons, or 270 gallons per cow. The exports of butter from France in 1895 amounted to 511,546 cwt. In 1895 the value of the milk produced was officially estimated at about 6¾d. per gallon, and the value of the butter exported was put at about 8¾d. per lb. for salt and 11¾d. for fresh butter, or 3¼d. and 4¼d. respectively per gallon of milk employed.

In Sweden, co-operative dairies have been established in districts in the south-west, and they now number 302 as compared with 73 in 1891. There are over 700 estate dairies and about 500 commercial dairies in different parts of the kingdom, the latter being run for the most part by joint-stock companies purchasing milk from the farmers. In 900 of these establishments the cream is separated by centrifugal separators, and in 500 of them the Schwartz process of separation is employed. The exports of Swedish butter amounted in 1895 to 53,000,000 lb.; about 60 per cent. of it is consigned directly to the United Kingdom, nearly all the remainder is shipped to Denmark, whence a considerable quantity is again exported to British ports. According to the latest official estimate the number of cows in Sweden is 1,683,116, or about 345 per 1,000 of the population.

Dutch butter does not now form more than 8 per cent. of our annual imports, but it formerly held a more important position in the markets of this country. It is noteworthy that the decline of the export trade in butter from the Netherlands has been concurrent with a great development of the manufacture of margarine. The exports of the latter have only been separately distinguished from those of butter in the Dutch trade returns since 1890, but they apparently reached their greatest dimensions in 1892, when they amounted to 135,000,000 lb.; they have, however, since declined to less than 100,000,000 lb. During the past five years the quantity of Dutch butter exported annually has averaged about 29,000,000 lb. Holland's largest customer for both natural and artificial butter is the United Kingdom.

In 1891 there were thirty-two large margarine factories in operation in the Netherlands. The factories differ greatly in size and capacity, but all of them are equipped with modern machinery and appliances, and those of comparatively recent construction represent large investments. A representative factory, situated in North Brabant, providing employment for 200 men, is said to produce and ship regularly 25 tons of margarine weekly. It consumes each week an average of 33,000 gallons of milk: the yield of 10,500 cows, owned by 2,000 small farmers living in the adjacent rural districts. The number of cows in Holland is 877,200, or 185 per 1,000 of the population.

Although German butter reaches our markets in consignments amounting in the aggregate to over 100,000 cwt. annually, Germany has really produced in recent years barely sufficient quantities of this article to meet the needs of her own population. About 80 per cent. of the butter exported is sent to the United Kingdom, and the remainder is mainly consigned to Denmark. The imports are drawn chiefly from Austria-Hungary, Russia, and the Netherlands, but in 1896 about 18,000 cwt. were credited to the United States.

Butter-making in Germany is chiefly carried on by co-operative dairy societies, which are run very much on the lines of similar associations in Denmark. It is estimated that there are about 1,300 of these societies in various parts of the Empire the greater number being situated in the

northern provinces. In most of the co-operative dairies the cream is separated from the milk by the centrifugal process and manufactured into butter, the skim-milk and butter-milk being returned to the members.

In 1892 the number of cows in Germany was 9,946,000, or 198 per 1,000 of the population.

Some particulars have already been given above of the results shown by the balance-sheets of typical Danish co-operative dairies, and it may be interesting for purposes of comparison to notice here the accounts of two co-operative dairies in Germany, one of which is situated in Mecklenburg and the other in Hanover. The former is the property of a society consisting of twenty-three members holding 1,400 cows. The quantity of milk dealt with by this dairy in the year ended June, 1895, was 646,209 gallons. Practically the whole of the cream was manufactured into butter, and a large quantity of the separated milk was used for the manufacture of cheese. The working expenses, including interest on capital sunk and a payment to the reserve fund, were £1,835, or 5s. 8d. per 100 gallons of milk. The price paid to the members for milk supplied during the year was 39s. 8d. per 100 gallons, and the receipts were 45s. 9d. per 100 gallons of milk. Thus, in this case the total returns to the shareholders amounted to nearly 5d. per gallon of milk.

The dairy in Hanover is a smaller concern, manufacturing butter only. In 1895 the quantity of milk manipulated was 315,478 gallons, which was paid for at the rate of 27s. 11d. per 100 gallons. The working expenses, including interest, capital, and depreciation, amounted to 5s. 2d. per 100 gallons, and the total receipts to 33s. 11d. per 100 gallons, so that the sum received by the members worked out to about 3½d. per gallon, but in addition they received from the dairy, free of charge, 70 per cent. of the separated milk and butter milk.

The bulk of the butter exported to the United Kingdom from Australasia is the produce of Victoria, where there has been a great extension of dairying since the introduction of butter factories about eight or nine years ago; the erection of these establishments having been promoted by Government grants in the shape of subsidies and bonuses, which, however, have been discontinued since 1893–94. In 1895 there were 155 butter and cheese factories working in the colony, and they produced nearly 27,000,000 lb. of butter out of an estimated total production of 35,580,000 lb.

The factory movement is also beginning to spread in the other Australian Colonies. In Queensland, factories or creameries have been established wherever milk is procurable in any quantity, there being fifty of these establishments in the southern part of the Colony in 1894. A similar development is taking place in New South Wales* and South Australia. In the former Colony the co-operative dairies are gradually being superseded by by large butter factories, which are supplied with cream by numerous creameries.

The export trade in butter from the last three mentioned Colonies is, however, as yet of insignificant proportions. In New Zealand, whence we received 56,000 cwt. of butter last year, butter factories and creameries are being established in increasing numbers annually, and it is estimated that there are now about 208 of these establishments in operation.

American butter has hitherto constituted a very small proportion of our imports of this commodity, but in recent years the receipts from the United States have been of increasing dimensions, and in 1896 they amounted to about

* See note, page 907.

142,000 cwt. The transatlantic traffic in dairy produce is, however, made up for the most part of heavy consignments of cheese to the British market. Until 1891 the larger share of this trade was enjoyed by the United States, but during the past six years Canada has been the principal contributor. The bulk of the cheese exported from the former country is made in the State of New York, which has contributed about 79 per cent. of the exports of this product from the United States during the past five years. In several years prior to 1886 the exports of cheese from American ports exceeded 100,000,000 lb., but during the past decade they have steadily declined, and in the twelve months ended June, 1896, they amounted to only 34,000,000 lb. In 1890 it was estimated that about 50 per cent. of the cheese manfactured in the United States was produced in the State of New York, and that is probably the proportion at the present time. The magnitude which the industry has attained in New York is explained by the fact that it was in this State that the factory system of cheese-making was first introduced, and it is here that it has found its greatest development. According to an enumeration made by the Commissioner of Agriculture, there were 1,032 cheese factories and 311 creameries in existence in the State in 1894. The factories vary in size—an average establishment produces from eight to ten cheeses a day, but some make only five or six cheeses daily, and others make as many as twenty-two a day in the height of the season. The milk is usually drawn from farms within a radius of between 2 and 3 miles from the factories. The latter are sometimes owned by single proprietors, but the greater number are joint-stock concerns. In either case the system of management is the same—the farmers supplying the milk are credited with the total weight of milk supplied, which is paid for according to the quantity required to make 1 lb. of cheese, on the basis of the selling-price per lb. of the manufactured article. Few factories have adopted the method of paying on the basis of the fat contents of the milk. The manufacturing season extends as a rule from April to November.

The total quantity of butter exported from the United States was nearly 12,000,000 lb. in 1894; in the following year it had decreased to 5,600,000 lb., and in 1896 it amounted to 19,400,000 lb. About 85 per cent. of the butter produced in the country is made on farms, although in the eastern States there is a considerable number of creameries and factories. The estimated number of cows in the United States in 1896 was 16,138,000, or 226 per 1,000 of the population.

The United States has for many years furnished the bulk of the oleo oil, neutral lard, and cotton-seed oil for the European margarine industry, but manufactured margarine is not exported in any quantity from America.

We have already seen that Canada has recently succeeded in securing the greater share of the foreign cheese trade of the United Kingdom. In 1880 the total exports of the cheese from the Dominion amounted to 40,000,000 lb.; ten years later the quantity exported was 94,000,000 lb., and in 1895 it was 146,000,000 lb. Canadian butter, on the other hand, is exported in comparatively small quantities, the average annual exportation having been about 5,000,000 lb. during the past five years. The number of cows in Canada in 1891 was 1,857,000, or 384 per 1,000 of the population.

The bulk of the cheese produced in the Dominion is manufactured in factories of which the greater number are owned by joint stock associations of farmers. A large number of cheese factories have recently been equipped with plant for the manufacture of butter during the winter. This movement in the direction of winter dairying was practically begun by the establishment in Ontario of two co-operative dairies in 1891, and similar establishments for

the production of butter have now sprung up in Quebec, Nova Scotia, and Prince Edward Island. As a result of the extension of the winter dairying, great efforts are being made to expand the trade in creamery butter with the United Kingdom, and the Government of the Dominion has made arrangements for a chain of cold storage service from the producers in Canada to the consumers in Great Britain, in order that the butter may be marketed in good condition. As a further stimulus to the development of the creamery system, the Canadian Parliament has recently appropriated a sum of £3,125 for the establishment and maintenance of creameries in the North-west Territories. The amount voted is to be distributed in loans to joint stock companies of farmers, or to butter and cheese manufacturing associations, for the equipment of creameries and skimming stations. The companies or associations are required to provide the necessary buildings, and also to guarantee a supply of milk from at least 400 cows. The Government undertakes the management of the establishments for the equipment of which these loans are advanced, and not only manufacturers but also markets the butter at a charge to the company or association of 2d. per lb. This arrangement continues until the loan is repaid, when the equipment of the creamery is vested in the parties to whom the loan was originally made.

In conclusion, attention may be directed to the progress of co-operative dairying in Ireland. According to the latest report of the Irish Agricultural Organisation Society, the dairy societies, or creameries, in Ireland now number 93, including ten auxiliaries or branches, with a total shareholding membership of 8,750. The quantity of butter produced by the societies in 1896 amounted to 2,791 tons, and the average price realised was 95s. 8d. per cwt. The average price paid for milk supplied by the shareholders was 3·55 pence per gallon. Many of the Irish dairy societies also undertake the purchase of farming requisites on behalf of their members.

From this short review of the systems and processes pursued in the several countries and colonies which supply the markets of the United Kingdom with dairy produce, it is clear that one feature which is more or less common to them all is the concentration of the manufacture of butter and cheese in large dairies and factories, co-operative or otherwise, drawing their supplies of the raw product from a number of farms situated within a convenient radius. In the greater number of these establishments the whole of the processes of manufacture are carried out on the premises, but some of them are equipped only for the manipulation of the cream, and in Normandy and Brittany the butter factories confine their operations to the blending and grading of the manufactured product. The object of all is, however, the same, viz., the production of an article of uniform quality and appearance at the lowest possible cost, and the facts illustrated by the import statistics afford *primâ facie* evidence that the factory system has worked with success especially in countries where it is combined with co-operative principles, of which the Australian Colonies and Denmark are notable examples.

Note.—Concerning the statement as to the development of the dairy industry of New South Wales, it may be mentioned that according to the Customs returns, 98,005 boxes (56 lb.) of butter have been exported from Sydney during the period 1st January, 1897, to 20th December, 1897.

The Influence of Bees on Crops.

(Continued from page 833.)

ALBERT GALE.

Some of the writers I have referred to have given their experience of watching bees searching for the nectary, and the insects' apparent failure to discover it at first sight. When bees are seen searching about the essential organs of flowers it is not the nectary they are in search of, but the gyrations they make are for the purpose of collecting the grains of pollen. If a bee is seen at work on a sunflower or other composite bloom, her movements in gathering pollen differ greatly from those in collecting honey. Every leg is brought into play in the former work, and her motions are as systematic and various as the figures in a country dance. How differently she goes to work in collecting honey. Her head bends towards every expanded flower, and her tongue is thrust into every nectary. At some she pauses momentarily—some insect has been there before her; at others her stay is longer; she has her reward.

Notwithstanding an insect may have rifled the nectary of its honey, and when visited by the bee found to be empty, in a few minutes another or the same bee will revisit it, and this time her stay may be longer, because between the two visits the nectary will have secreted another supply. The indecision of the bee at a flower is no proof that she is looking for the position of the nectary.

To-day bees may be industriously at work upon a flower of certain colour, and to-morrow forsake it for one of less conspicuous shade. "It would appear," says Darwin, "that either the taste or the odour of the nectary of certain flowers is unattractive to hive bees, or to humble-bees, or to both, for there seems no reason why certain open flowers which secrete nectar are not visited by both. The small quantity of nectar secreted by some of these flowers can hardly be the cause of their neglect, as hive-bees search eagerly for the minute drops on the glands on the leaves of the *Prunus laurocerasus*."

"The small quantity of honey secreted" is the cause. Within a near radius there were, undoubtedly, flowers that were secreting larger quantities of honey, and both humble and hive bees always visit flowers where they can gather the greatest quantity in the shortest space of time. When the hive-bees were searching "eagerly for the minute drops on the glands on the leaves of the *Prunus laurocerasus*," the honey flow must have been scarce elsewhere. I have seen bees in time of famine search the most unlikely places in the hope of getting something to take home. "A drowning man will catch at a straw," and a bee on short allowance will do the same.

Some years ago, at Cooma, in a dry season, a bed of turnips ran to flower. They were sown on a sandy, thirsty soil. For three or four days they were besieged by bees. Almost suddenly the bees ceased to visit the turnip blooms,

although they were still expanding. The cause of their forsaking the turnips became evident. About one-third of a mile away, on the banks of a creek, a small paddock of lucerne had flowered, and the bees were bestowing their attention on it, because it was yielding a greater supply of food. Their harvest from the lucerne lasted but a day or so. The scythe stopped the honey flow, and the bees returned to the turnips. Was it the dark-blue flower of the lucerne that caused the bees to forsake the creamy yellow flower of the turnip, or the superior quantity of honey contained in the lucerne? Undoubtedly the latter. The whole family of trefoils are well known to be great honey-producers.

Whatever may have been the reason for plants to have brightly-coloured flowers, and to be otherwise decorated so as to attract insects to aid in the work of the development of the vegetable world in past ages, it is evident in these later times the bees at least have been sufficiently educated to go without leading strings, and have kicked over the traces, and now work according to their own sweet will, or a higher one.

Darwin himself is not quite sure that the colours and markings of flowers in every case are for the sole purpose of attracting bees.

I have before remarked that bees do not work indiscriminately on every species of flower that comes to hand, notwithstanding they are all honey-producers; but one peregrination is confined to collecting from one species, and in the next ramble they may select another, and so on. Whatever species of flower they may select to gather from, it is not the colour of the bloom that is the attraction. In watching bees at work on a bed of poppies, the brightly-coloured flowers are not chosen in preference to white. Any colour in the bed is as attractive as that of any other.

"Bees repeatedly passed in a direct line from one variety to another of the same species, although they bore very differently-coloured flowers, I observed also bees flying in a straight line from one clump of yellow-flowered *Œnthera* to every clump of the same plant in the garden without turning an inch from their course to plants of *Eschocholtzia*, and others with yellow flowers, which lay only a foot or two on either side. In these cases the bees knew the position of each plant in the garden . . . . so that they were guided by experience and memory."* The experience they had gained was that *Œnthera* contained more food than *Eschocholtzia*, and Nature had taught them that it would be impossible to impregnate the ovaries of the one with the pollen of the other.

What is our Australian experience as it regards the colour of flowers that are chiefly visited by bees? There is no denying that some of our endemic flowers are as brightly coloured as the exotic; and, before the introduction of foreign plants and the bee (*Apis mellifica*), the chief honey-gathering social insect was the little native bee (*Trigona carbonaria*), one of the chief insect fertilisers in Australia. The chief honey-yielding plants in these colonies are the *Eucalyptus pittosporum* and the tea-tree (*Leptospermum* family). The colour of the native flowers named are whitish, with a few exceptions. The chief exotics that have been introduced are fruit-bearing and ornamental flowering plants, which nearly in all cases bear brightly-coloured flowers or blossoms. The exotic, white, flowering fruit-trees in the spring-time are very conspicuous by the multiplicity of the blooms they bear; yet our little native bees now as readily find the nectary in them as our introduced bees, and they cannot have had ages of experience to guide them.

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* Darwin, in "Cross and Self Fertilisation of Plants."

On the other hand, it is very singular that the hive-bee, on its introduction into Australia, and before it had been sufficiently colonised, should forsake the highly-coloured garden flowers of the Old World that were introduced here at about the same time as the bee. These highly-coloured flowers and the hive-bee, as far as Australia is concerned, are coeval. Untold generations of them had learned to work these blooms, we are informed, and their experience had greatly aided in the development of species and the production of showy flowers of the land of our fathers. On the introduction of the bees and the flowers referred to, the former appear to have suddenly turned their attention from the latter, and apprenticed themselves to the work of attending to the whitish native honey-bearing flowers of the Colony—a colour that the writers on the subject say the bees studiously avoid for the more gorgeously-coloured ones their progenitors had been at such pains to produce by erecting those bright-coloured signs for the benefit of the bees of to-day, for the purpose of saving them both time and labour. Nevertheless, the hive-bee, when introduced here, after having been educated to the highest standard in the recognition of colours they are said to possess in Europe, have started *de novo*, and worked upon, not our introduced ornamental flowers, nor our showy blooms of "red, blue, and purple," but upon "simple white or yellow ones"; so unlike the education in colours they had received in the other side of the world. Question—Will our eucalypti and acacias, and other white and yellow flora, in ages to come, develop highly-coloured flowers and of a larger size than at present, and will the bees then forsake the colours they now work upon in the same way they are said to have done in the other parts of the world? It is queer bees should have gone back in their tastes for colours, when they crossed the Line in coming to this side of the world.

Some years ago a series of questions were submitted by the Department of Agriculture to the bee-keepers of this Colony, relative to what plants were visited by bees as regards size and colour of blooms.

In the ranks of the bee-keepers are men of keen observation as to whence their honey flow comes. The whole of the answers given are full of interest. Of course, the imported fruit trees and other exotic flowering plants are named as giving the spring supply of pollen and honey, but the ironbark, grey gum, bloodwood, blue gums, and the eucalypts generally are by far the most remarkable as honey-yielding, and all these have white flowers. On the northern districts the broad and narrow-leaved tea-tree is stated "to be the largest honey-yielder we have"; therefore its *white* flowers are the attraction. One bee-keeper states that "one year he grew a plot of *white* poppies for experiments with opium, and found the flowers literally crowded from daylight to dark with bees."

The report concludes by saying, "Regarding the size and colour of flowers most affected by the bees, much diversity of opinion exists among apiarists." . . . . It is, indeed, an open question if colour has any effect in the matter." In the report one observing bee-keeper quaintly observes, "The bee is quite indifferent to the size of a flower, provided he can get what he wants"; and, from experience, I can add, quite indifferent as to colour.

Bee Calendar.

ALBERT GALE.

JANUARY.

WITH the horticulturist "there is always something to tie, or to stick, or to mend"; so with the bee-keeper. Although there is no delving and digging, still every month brings its allotted work. The hot days of January are very trying to both bees and bee-keepers. The latter is wishing he could work under an umbrella or other sunshade. Well, this autumn, prepare for next summer, unless you have been sufficiently wise to have followed the advice given in the article on "Summer and Winter Protection for Bees," given in the *Agricultural Gazette* for May, 1895. In some parts of New South Wales undoubtedly the bees are suffering from the excessive heat—combs are melted, bees suffocated, and honey running to waste, causing an abundance of robbing to be carried on. During this great heat, if you cannot protect yourself, you must protect your bees from such accidents as above recorded. If there be no natural shade, an artificial one must be at once adopted. A sheet of bark sufficiently large to extend about a foot over each side of the hive will answer the purpose splendidly. In the absence of it, a piece of board or an old bag, can be substituted. Permit the bag to hang down on either side of the hive. In the first place, put a couple of pieces of stick across it so as to leave a sufficient space for air to circulate. Weight the covering, whatever it might be, to prevent the wind from blowing it off.

Most of the directions for last month will also apply to this. Prevent swarming, if honey be desired; but if it be intended to increase colonies it is not too late to do so, as there is plenty of time for gathering in the winter's stores. Remove sections as they become capped, and store them for use. Occasionally overlook them for the purpose of keeping the bee moth down. If it gets a footing amongst them great damage will be done Give all the ventilation possible at the mouth of the hive. It will be noted that all the young brood, perhaps none of them, are sealed over. In very hot seasons bees make it a rule not to seal brood in a chrysalis form. A small hole is left for extra ventilation. The bee-keeper must aid them as much as possible by removing all obstructions from the entrances. If the bees are seen hanging idly in clusters outside the hive, as they do sometimes before swarming, see that there is plenty of room inside for storing.

A Sulphuring Bung.

M. BLUNNO,
Viticultural Expert.

In many wine-shops and restaurants, as well as in many households, the wine for daily consumption is kept in small barrels, hogsheads, or similar vessels, from which it is broached through a tap.

The wine, formerly sound, after a few days of ullage becomes acid in flavour, and before the cask is totally empty the remnant drink is as sour as vinegar, so also is all the inside of the vessel.

This is because few take the trouble to fill, with the fumes of sulphur, the

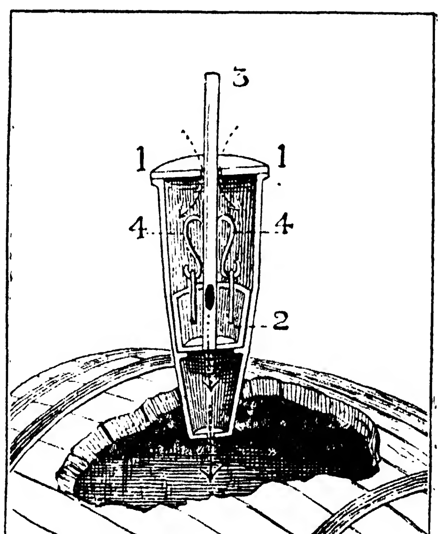

Fig. A.

empty space which is formed at each pouring off of the drink, and so preventing contact of the air with the top strata of the wine.

Air in the ullage space, with a temperature of 82° to 84° and over, according to the character of the wine, provides the most favourable conditions for the life of the *Diplococcus aceti* that is responsible for part of the alcohol turning into acetic acid, which gives the wine the sourness of vinegar.

Sour wines with vinegary taste must be very common, if I may judge from the fact that many people cannot detect the acidity even when it is very pronounced, because very likely they have become used to it.

One of the injuries inflicted upon the reputation of Australian wines is the, in most cases, unintentional neglect to preserve the soundness.

In the case, however, of vessels in ullage, the cellarman sometimes, in spite of his willingness, cannot fill the empty space with fumes of sulphur, because there is not enough air for alimenting the combustion of the sulphur.

If he has any of the same wine, or in any way similar to it, the question is easily resolved by using it for filling up; but, if not, he is rather inclined to leave the vessel in ullage, hoping that there will not be much harm done.

There are several systems to smoke the empty space when the ullage is not sufficient as to allow the match burning.

I shall illustrate two of the most common and handiest.

The sulphuring bung, as shown in Fig. A, is by Mr. Fage, of Narbonne.

It is composed, Fig. A, of a sort of cone of tin with a cover inside of which there is a sort of cup 2, having a stem 3, on both sides of this stem two hooks, 4, are soldered, and two matches of sulphur are hanging on them.

To put it in action lift the cover 1, then take the cup out, place the matches and light them, put the cup inside the cone again, put on the cover and insert the instrument in the bung-hole, but in the meantime open the

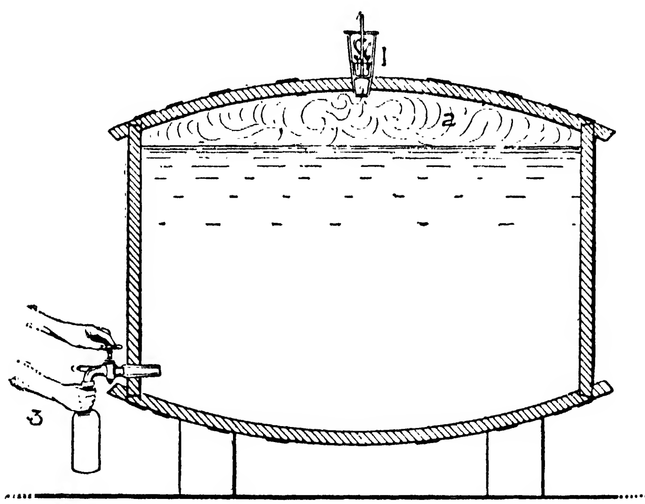

Fig. B.

tap and start to pour off the wine, fig. B. A draft of air will get, as shown by the arrows in fig. A, in the cone, alimenting the combustion of the sulphur, its fumes will also be driven through the hole in the stem (shown near the rim of the cup) into the empty space, indicated by the two vertical arrows, see fig. A and also fig. B.

When you have drawn the quantity of wine you want, stop the tap, take the instrument away, and bung down with the ordinary wooden bung.

You may be sure that for any quantity of wine taken from the cask through the tap a quantity of fumes of sulphur of the same volume will be drawn with the described system into the cask.

Another very simple method adopted in the same direction is the use of a sort of fireplace of tin, fig. C. A diaphragm, 2, all perforated, is inside the fireplace; on the diaphragm the matches or even pieces of sulphur are lighted and then the door shut, the necessary air to the combustion coming from the holes, 1. The fumes are led through the pipe into the empty space 3.

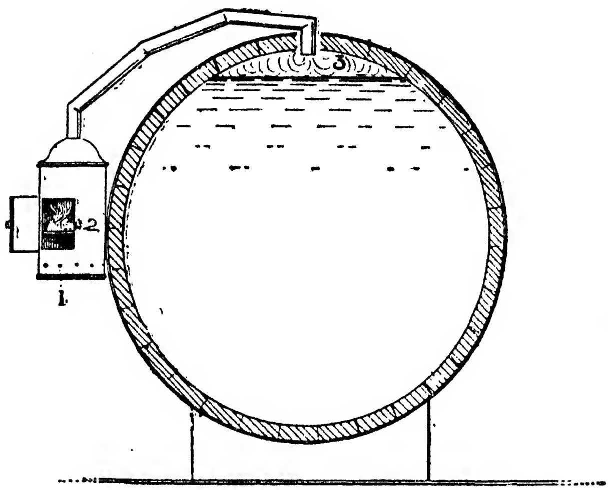

Fig. C.

When this is full of smoke you will see the fumes escaping from the bung; stand a few minutes more, to be surer, and then take the smoker away and bung down in the ordinary manner. The piping is about 1 inch in diameter. Owing to the space thus left between the piping and the bung some of the fumes may escape. To prevent this a piece of cloth may be used to chock the bung.

Orchard Notes for January.

GEO. WATERS,
Orchard Manager, Hawkesbury Agricultural College.

THE month of January is always a busy one for the stone-fruit grower and vigneron especially. Just now the citrus-fruit grower has a tolerably slack time. Gathering, packing, and marketing of fruit is the principal work, the mid-season peaches, nectarines, and Japan plums starting now. The old subject of the fruit case arises every year, and it really appears that, in spite of the fact that a definite size of case was decided upon at the last Fruit-growers' Convention, still we do not seem to be much nearer the settlement of the question. There is no doubt that if the fruit was put up into more convenient sized cases, and of a uniform measurement, that the public would have greater confidence in buying, for even the everyday buyers cannot give an accurate idea of the contents of the many sized cases, and when they do arrive at a conclusion they naturally allow for an error, and offer less than the case is worth. One of the most important points is the grading. Surely no grower and seller would not admit that evenness in size, be it large or small, makes the case more presentable. A glance at one of the shops of the Italian vendors of fruit shows how much they must grade and regrade, so as to get samples of different prices. For summer fruits, really no machine is yet on the market that will do this work of grading without bruising, so it must be done by hand. Almost all of the apples sent from Hobart are graded by hand, and it is wonderful how expert some of the operators are. Passing, I might mention that, on seeing some of their cases opened and examined, it was surprising how even the fruit was, and I may say that most of it was done by lads. Delicate fruits of extra good quality should also be wrapped. A very cheap wrapping-paper, cut into convenient sizes, is now obtainable in Sydney.

Keep a good look to the grape vines, both for topping and lateral pruning; also, where "spot" or "oidium" should be prevalent, now that the berries are getting of good size, it will not be advisable to apply any spray that will discolour the fruit in any way.

Too much stress cannot be placed on the necessity for frequent cultivation during hot, dry weather, not only to keep the weeds down but to prevent evaporation. If we should be fortunate enough to get a little rain, or if irrigation be practised, run the cultivators over as soon after as possible to prevent caking of the surface.

During this month make preparation for canning, bottling, or drying all the surplus fruit for household use during the winter. Do not waste anything. In the early part of the month some apricots will be ready for drying. On every orchard a certain amount of fruit gets too ripe for marketing fresh, and this is the very condition, viz., quite ripe, that you want the fruit for drying. . Mr. Allen, the Fruit Expert, has dealt exhaustively with this subject in the November issue, so it will not be necessary to say anything in these notes. At the same time I would advise anyone who expects some

spare fruit to purchase or build a dryer (plans of several have appeared at different times in the *Agricultural Gazette*), that is, provided that in your district you cannot dry successfully in the sun. No doubt the purchasing of a lot of preserving jars runs into a fairly large amount, whereas if the same fruit were dried it could be kept till required; all that is necessary being to wash and steep overnight, and it is ready for use.

Where not already done, the late pears and apples that require it could be thinned now.

Towards the end of the month any summer pruning necessary should be done. Any long or broken branches on young cherry trees can be removed now even better than in the depth of winter. Apricots that have grown too vigorously to permit of the proper setting of the fruit spurs should be cut back about one-third of the length of the current year's growth. The same applies to Japan plums, some of the varieties of which are extremely vigorous growers.

During the month probably many pests may be present, such as codlin moth, crickets, and, in some places, grasshoppers. The bands that should be on the apple and pear trees ought to be examined about every week or ten days, and all fallen fruit destroyed as soon as it falls, feeding them to pigs or boiling them down. The cricket pest seems to be decreasing, but if plentiful keep the land quite clear of weeds, so that they are not harboured, and by using the mixture of treacle and arsenic made into balls and placed in their haunts you will be able to reduce their numbers.

Budding, especially where old trees are to be rebudded, can be started this month.

Where the useless early peaches are being reworked, see that good useful varieties are put on. The following among peaches are splendid varieties, selling well in the fresh state, for drying or canning :—Early Crawford, Elberta, Late Crawford, Globe Susquehanna, Comet, Lady Palmerston, and Salway, Princess Royal, Muir, Foster. Among apricots many absolutely useless varieties are grown. Where these are to be reworked the following varieties are the best :—Moorpark, Alsace, Blenheim, Royal, and Hemskirk. The Japan plums also thrive well worked upon old apricot trees. Among these the following are best:—Satsuma (blood), Suika Momo (blood), Burbank, Botan or Abundance, Wickson, October Purple. Many of the varieties of Japan plums that have been introduced are almost entirely worthless as market varieties. Any grower having any of these would be wise to bud on some of the above varieties.

Practical Vegetable and Flower Gardening.

W. S. CAMPBELL.

Directions for the Month of January.

Vegetables.

It should be pointed out that it is necessary to write these directions some considerable time before the work recommended can be carried out, as the *Agricultural Gazette* is only published monthly. Therefore, it is not possible to form a correct idea of the state of the soil or the state that the weather is likely to be during the months for which the directions are given. January is frequently hot and dry, but it is not improbable, considering the long drought from which we have been suffering, that rains may come at any time during the month in sufficient quantity to soak the soil enough for the growth of vegetables. The soil should be well stirred on the surface between the rows of growing vegetables during dry weather, but it is almost an impossibility to grow vegetables in the dry hot districts of this Colony without a great deal of water, unless rain falls in quantity. Near the coast, especially in some localities, there is generally ample rain, so that vegetables should be forthcoming in abundance.

I feel confident that moisture-retaining power of soils in dry districts can be greatly improved by the application of heavy supplies of dung, or by the digging or ploughing in of green crops, such as the cow-pea.

Liquid manure—manure made by soaking the droppings of farm animals, horse, cow, and poultry in water—will be found of great value for the growth of vegetables, especially if the liquid portion of the animal excreta can be obtained and used as well; but this is a difficult matter to secure in the country, where little or no stabling is done.

The planting out of cabbages, leeks, celery, and other plants should be done with care; and the young plants, unless the soil is in a good moist condition, will need watering both before removal from the seed-bed and after they are planted.

The sowing of seeds, too, should not be done if the soil is dry, without frequent waterings. If they are watered and allowed to become dry, it is probable that their vitality will be destroyed, and no plants will come up. If watering be commenced it must be continued, or failure is almost certain.

Bean, French or Kidney.—This vegetable may be sown as largely as may be required. The best plan to adopt is to sow a row or two once a week, or perhaps it would be better to sow a row, wait until the plants have come up, then sow another row, and so on. The ground should be well dug before sowing, and if it is not naturally sufficiently rich, it should be heavily manured with well-rotted farm-yard manure. It may be as well to state that if chemical or artificial manures are used, sulphate of ammonia, nitrate of soda, or manures known as nitrogen or ammoniacal manures, are of little

if any use for French beans. Lime, gypsum, potash, or sulphate of lime are the best substances to apply, but it is hardly possible to do better than apply plenty of well-rotted stable or farm-yard manure for any vegetables whatever. This is always safe, and, as a rule, most effective.

Beet, Silver.—Sow a little seed, and transplant from the seed-bed if there are any plants sufficiently large to move. The leaves of this plant are used, and make a very palatable dish, if they are properly boiled.

Cauliflower.—This month is a good time to plant out cauliflowers from the seed-bed. In the first place, prepare some ground by trenching if possible, or deep digging, and thoroughly well manuring, mixing in the manure well. If the soil is dug or trenched deep the roots of the cauliflower will descend to a considerable depth in search of food, and will not suffer from dry weather. Select good strong sturdy plants and set them about 3 feet apart each way. Do not break or injure the roots more than can be avoided when raising the plants from the seed-bed. Sow a little seed in a seed-bed or box where it can be shaded or watered easily.

Cabbage.—Sow a little seed and shade and water. Put out a few young plants in well-manured and well-prepared ground.

Celery.—A little seed may be sown, and a few plants put out in well-manured or rich ground. This vegetable will need to be well watered and also treated to occasional supplies of liquid manure.

Carrot.—Sow a little seed in drills, taking care to separate the seeds well before they are sown. Thin out any young plants that may be coming on, and be careful to keep them free from weeds.

Kohl rabi, or turnip-rooted cabbage.—A few seeds may be sown in a seed-bed. Seedlings to be planted out later on when they are large enough to move.

Lettuce.—Instead of planting out from the seed-bed it will be better, at this season of the year, to sow in rows in a richly prepared bed in the garden and thin out the plants to about 9 inches apart when they come up. If lettuces are transplanted just now they are very apt to run to seed.

Maize, Sweet.—It is late to sow seed, unless it is done very early in the month, and then only in the warm coast districts.

Peas.—In the coolest parts of the Colony a few rows may be sown.

Potatoes.—Prepare a bed for planting by deep digging, well draining, and heavily manuring. When ready, plant some variety of the kidney potato. Use medium-sized whole tubers, for they will probably succeed better than large ones cut into two or more pieces. The rows should be from 2 ft. 6 in. to 3 ft. apart.

Raddish.—A supply of this vegetable, if young and tender, is always useful. It can be sown during every month of the year. A very little seed should be sown at a time. If well grown, the tender leaves may be eaten as well as the root. Make the ground fine and manure well with rotten dung. Sow in little rows, thin out, and keep free from weeds.

Red-beet.—Sow a row or two of this useful salad vegetable on some ground that had been previously heavily manured for cabbage, potato, or some other crop. The seed will probably take a long time to come up, especially if the ground is dry. If it be thoroughly soaked in water before it is sown, and the drills in which it is planted also well watered, it will come up much sooner.

Savoy.—Sow a little seed. This is one of the best of the cabbage class, which will succeed better in rather cool districts, although it may be grown in almost any part of the Colony.

Tomatoes.—In most gardens there should be good supplies of ripe fruit. Some means should be adopted to keep the branches or vines from lying on

the ground and thus rotting the fruit. They are awkward plants to tie up if allowed to attain full growth before the tying up is attempted. The work should be done as they grow. Bundles of sticks, prunings of fruit-trees, or dead branches of trees can be spread under the plants, and this will answer in a rough way to serve the purpose. If required, young plants may be put out to keep up a succession of fruit.

The month of January is generally considered to be an "off" month for vegetables, and there is often a scarcity if the weather prove to be dry; but, with a little care and trouble, if a good supply of water is available, quite sufficient may be raised for all requirements.

If onions and shallots are ready for lifting care should be taken to do the work without bruising them, and after they are raised do not, on any account, leave them in the sun to dry, or else they will not keep for any time.

Flowers.

Chrysanthemums will require a good deal of attention this month, for it is time now to make them grow as well as possible; but it should be remembered that the plants require a considerable amount of moisture during their growth, in order to enable them to produce their flowers to perfection. They should be sprayed daily in the evening with clean water; liquid manure made from cow-dung, mixed with some soot, is very suitable for their wants, and sometimes for a change some sulphate of ammonia, say 2 ozs. dissolved in a gallon of water, may be applied with advantage.

The plants which are grown for producing extra good flowers, such as may be seen at horticultural shows, should be confined to one stem, and all suckers which grow around this stem should be broken off below the ground, and not allowed to grow. These suckers are very persevering, and it will need much attention to keep them in check. Caterpillars are very destructive to the plants, and they should be looked to, and means should be taken to destroy them. It is very interesting work growing exhibition chrysanthemum flowers, but it necessitates a deal of attention, and unfortunately the period of flowering is of such short duration. With roses and bouvardias it is quite a different matter, for they continue in bloom for months if but very little attention be given them in cutting off the seed vessels when the flower petals die off, in pruning back to some extent, and in supplying them with some liquid manure from time to time.

Dahlias, where the season has been favourable, are making good strong growth. If the soil becomes very dry, they should be well watered, or else they may die off suddenly. Tie them up to stakes as they grow, to prevent winds breaking them down.

Carnations, which are becoming great favourites everywhere, must not be allowed to become very dry at the roots. They need a good deal of moisture.

A mulch of stable dung around all the garden plants will perhaps save many of them from destruction.

General Notes.

Silos and Ensilage.

Writing on the subject of silos and ensilage, Mr. E. C. Chilcott, Agriculturist of the Dakota (U.S.) Experiment Station, says :—

" Silos and silage have long since passed beyond the 'fad' stage. The time has been within the last twenty years when many enthusiastic advocates of silage made most extravagant claims, such, as for instance, that by the use of the silo the nutritive value of a crop could be doubled, or in other words, that double the amount of stock could be kept upon a given area, where the fodder was converted into silage.

" On the other hand there were those who claimed just as strongly that silos were not only expensive and impracticable, but that silage was unfit for any kind of stock, and that the feeding of it would eventually result in the death of the animals eating it, from derangements of the digestive organs, and that it would be impossible to make first-class dairy products from the milk of animals fed upon silage, which they declared was decaying vegetable matter, and totally unfit for food. All these, and many more statements equally foolish, were made on both sides of the question, until, as is usually the case, conservative men have learned that the enthusiasts on both sides were wrong, and that the truth lies about half-way between the statements made for and against the system.

" It is now generally admitted that the converting of green forage into silage adds nothing to its nutritive value ; it simply preserves it, much as canning preserves green fruit. It is also admitted that silage, when properly prepared, is a wholesome food for all kinds of stock ; and, owing to its succulent nature, it is particularly desirable for the dairy cattle and young growing animals. The need of some kind of succulent food for this class of stock is pretty generally admitted. Whether this succulent food can best be provided during our long, dry falls and cold winters in the form of silage or as roots must be decided by each dairyman for himself. Then again the question as to whether green forage crops can be most economically preserved in the form of silage, or by converting them into dry fodder, is one the solution of which will be largely governed by the varying conditions of different localities and farms.

" In order to ascertain the estimation in which silos are held by the leading dairymen of the United States and Canada, F. D. Coburn, secretary of the Kansas State Board of Agriculture, sent out a circular to representative dairymen in the United States and Canada, asking, among others, the following questions :—

" What is the smallest number of dairy cows for which a farmer would " be justified in building a silo ; and do you consider the silo " a necessity to the most profitable dairying ?"

"Sixteen answers were obtained to the first part of the question, and the average of all the answers was approximately 'fourteen cows.' Throwing out the answer of Jones, a Kansas dairyman, who put the number of cows at fifty, while the highest number mentioned by anyone else was twenty, we have an average of 11 2-15.

"Nineteen dairymen answered the second part of the question, of which eight were decidedly of the opinion that a silo was a necessity. Six stated that while a silo was not an 'absolute necessity,' that it was 'highly desirable,' 'the cheapest way of preserving green fodder,' 'silage is one of the best of foods,' 'I would not keep a dairy without one,' &c., &c.

"Five expressed it as their opinion, that a silo was not a necessity; but one (Haecker, of Minnesota), says he prefers to feed silage, simply because of its convenience.

"The other four, who thought a silo was not a necessity in Kansas, all base their opinion upon the fact that all kinds of coarse fodder must always be plentiful and cheap in Kansas where such an amount of corn is produced, and but little attention is paid to the stalks.

"I think we can safely make the statement that it is the concensus of opinion of the representative dairymen of the northern United States and Canada, that a dairyman having no more than twelve cows can afford to build a silo, and that the silo is a 'necessity to the most profitable dairying.'

"As to the relative importance of the silo in South Dakota, as compared with other dairy states, as already set forth in the introduction, we believe that, owing to the much shorter period here, as compared with the eastern States, during which cattle can get succulent food from our pastures, owing to the curing of our grasses on the ground, and the long and more severe winters, as compared with Kansas, the necessity of the silo in dairy husbandry in South Dakota is even greater than in most of the other dairy States.

"*Silos and how to build them.*—Granting that a silo is a necessity for the most profitable dairying, the next question that presents itself is what kind of a silo should be built. This is a much more complicated one than the one as to the advisability of building a silo at all.

"No one questions the statement that a dairyman should provide warm, dry, well ventilated, comfortable stables for his stock. How to accomplish this to the best advantage, with the available means, is a problem which nearly every man must solve for himself. There are hundreds of stables in our State that fulfil all of the above requirements, that have been built from sods, logs, straw, or poles, and represent very little outlay except the labour needed for the construction. Many of these come very near being the very best that could be built under the circumstances and conditions. At the same time, they are not at all the kind of stables that anyone would build under more favourable conditions.

"This silo problem is very much like the stable problem, which the farmers of this State have solved so ingeniously, and so well and in such a variety of ways; and it must and will be met and solved in much the same way just as soon as our dairymen recognise the necessity of the silo.

"The essentials of a silo are that it be an enclosure, with walls nearly air-tight, and of sufficient strength to resist the great lateral pressure of a mass of green silage. A roof is desirable to protect the silage from the weather, but is not absolutely essential. A covering of hay will usually turn any storm likely to occur after the silo is filled and until it is empty.

"The size of the silo should be such that it will contain one cubic foot of silage for each animal for each day of the feeding period. For instance, a silo for thirty cows, six months (180 days), should contain 30 x 180 = 5,400 cubic feet.

"The shape of the silo is of less importance than some suppose. It should be borne in mind, however, that a round silo (an account of this class of silo is given by Mr. Allen in the report of the Dairy Conference held in July at the Hawkesbury Agricultural College; copies of the Report may be obtained on application to the Department) will hold more in proportion to its wall surface than any other form; a square comes next. The walls of a round silo can also be made of very much lighter material than a square one, and still have the necessary strength. The higher the silo in proportion to its diameter, within reasonable limits, the more compactly will the silage settle; and consequently, the greater will be the capacity, and the better will the silage keep.

"The silo should be so arranged that not more than 5 square feet of feeding surface for each cow will be exposed at any one time; otherwise the silage, being so long exposed to the air is likely to spoil. If the diameter of the silo is too great to conform to this rule the silo should be divided by a partition, which may be of a single thickness of boards, as it has been found that the lateral pressure disappears very soon after the silage once settles.

"The cost of the silo varies between wide limits. The following description of a silo built at the Colorado Station will give an idea of how cheaply a silo can be built:—

"A silo was built on the College farm the past season to ascertain how cheaply one could be made, and whether such a cheap affair would answer equally as well as the more expensive for the preserving and feeding of ensilage. Silos in the east are not built below ground, because during half of the year the ground is saturated with water. No such trouble need interfere with the Colorado farmer. There are many places where a hole 8 to 12 feet deep would remain dry the whole year, and such a spot on the College farm was selected for the silo. It is on a slight slope, and a hole 21 feet square and 8 feet deep was dug out with a plough and scraper. The only handwork necessary was in the corners and on the sides. The dirt was dumped as near as possible to the upper end and the two sides.

"Inside this hole a 2 x 6 sill was laid on the ground, 2 x 6 studding 12 feet long erected, and a 2 x 6 plate put on the top. This framework was then sheathed on the inside with a single thickness of unmatched, unplaned, rough boards, such as can be bought almost anywhere in the State for $12 (£2 10s.) per thousand.

"The inside was lined with a single thickness of tarred building paper, held in place by perpendicular slats. The floor was made by wetting and tramping the clay at the bottom, while the stars of Heaven made an excellent and very cheap roof. . . . The ensilage put into the College silo last fall is now being fed out and proves to have kept well. When the silo was full it was covered with a small amount of straw, and the dirt from the sides thrown on to the top to form a layer 6 inches thick. Both the straw and dirt were soaked with water to make them pack tighter. When the silo was opened, from 2 to 3 inches of ensilage were found to be spoiled under the straw, and in the corners for a little greater depth. Below this the ensilage has kept remarkably well. No eastern silo with double walls of matched lumber could produce any better."

We might add to Mr. Chilcott's remarks that the general opinion in this Colony is that the tarred paper referred to is not absolutely necessary. Much of the success of ensilage depends upon the proper regulation of the temperature. This subject is fully discussed and explained in the "Farmers' and Fruit-growers' Guide," pages 113-116, and it would be well worth the while of anyone intending to put up feed in this way to carefully peruse the article.

The English House Sparrow.

This pest, now so widespread and troublesome in this Colony, is the subject of a comprehensive report by Miss Eleanor A. Ormerod, F.E.S., and Mr. W. G. Tegetmeier, M.B.O.U. (England), from which the following extracts may be of interest to our readers. It is rather late in the day now to talk about decisive action to stamp out this pseudo-scavenger; but if the good work of some of the Agricultural Societies, who offer rewards for sparrows' heads, could be supplemented by concerted action on the part of farmers and fruit-growers in the shape of destruction in all methods that ingenuity may suggest, much good might be done. The opinion that this bird is a difficult one to poison is the general one; but so far as we can ascertain, most of the attempts to induce the birds to take the baits are of a rough and ready description. In last issue, in reply to a correspondent, Mr. Guthrie, Chemist to the Department, indicates a method of poisoning grain that is worth trying.

The sparrow question is one which is still constantly recurring, as it has done for many years, and as it will continue to do, until reliable evidence of the nature of the bird's food is more accessible for general information than it is at present in this country. The mischief that is done by the sparrows is easily observable; but excepting in connection with these noticeable devastations, the nature of their food (meaning by this what the adult birds feed on throughout the year, and what the nestlings are fed on) is far from having been as well brought forward as is desirable, and the published records of as much as we know (whether for or against *Passer domesticus*) are neither as well before the public, nor as accessible to those practically concerned, as it would be well for them to be.

When, consequently on the ill-advised introduction by private enterprise of this bird into the United States of America, serious and widespread losses occurred from its destructive habits, an investigation into the nature of its food was set on foot under the direction of the U.S.A. Board of Agriculture, by examination of the contents of many hundreds of sparrows. These were submitted for identification to qualified members of the Ornithological Division, with final reference to Dr. C. V. Riley, the Entomologist of the Department, and the results were recorded both as to absence and presence of insects, and (where insects were present) their names and the order to which they belonged were given, together with information as to whether they were of habits helpful or hurtful to the agriculturist, or, as far as was known, neither the one nor the other; and these observations were published. In this country we have also good work on the subject, including observations and examinations made by known agriculturists, ornithologists, and other qualified investigators, comprising records of contents of very many hundred sparrows, and notes of the results of the absence or presence of the bird in various localities, and for various lengths of time, up to as much as fifteen consecutive years or more; some of these records are given in this pamphlet, in the hope that by gratuitous distribution they may be made generally accessible, and that further observations, also undertaken by properly qualified hands, may help to sound views on this important subject.

The most detailed account that is generally accessible of the food of the house sparrow, during each month of the year in England, is that given by the ornithologist, Mr. J. H. Gurney, of Keswick Hall, near Norwich. The table from which the following information was prepared shows the contents of the stomachs of six hundred and ninety-four house sparrows. The dissections were made by twelve or more qualified observers (names given with the table referred to), in various places, at regular intervals throughout the whole year, the observations being recorded under the heads of "Customary Food," and "Occasional Food."

In summarising his investigations, Mr. Gurney says:—

It may be said that about 75 per cent. of an adult sparrow's food during its life is corn of some kind. The remaining 25 per cent. may be roughly divided as follows:—Seeds of weeds, 10 per cent.; green peas, 4 per cent.; beetles, 3 per cent.; caterpillars, 2 per cent.; insects which fly, 1 per cent.; other things, 5 per cent. In young sparrows, not more than 40 per cent. is corn; while about 40 per cent. consists of caterpillars, and 10 per cent. of small beetles. . . . Sparrows should be killed for dissection in the afternoon. . . . If the sparrows are caught at night, they have digested their food in a great measure.

Some amount of good is noted by Mr. Gurney as done by sparrows feeding (in conjuction with other little birds) on seeds of various kinds of weeds, but the extent of benefit received in this way varies greatly according to local circumstances.

The observations of Col. Champion Russell, of Stubbers, near Romford, England, record the examination of the contents of the stomachs of sparrows shot over a wide range of country during fifteen years, and his conclusions are:—

On the whole, the deduction from the food-test, during fifteen years, seems to be that the sparrows are useless, and that the insects which would be given to their young by them, if they were allowed to live in numbers about my premises, would be so much food taken, when they most want it, from better birds which live entirely, or nearly so, on insects, and thus keep them, especially caterpillars, down so effectively in the absence of sparrows, that, when a chance pair of these come and build, there are few of their favourite sorts for them.

Investigations as to the feeding habits of the English sparrow were conducted on an exhaustive scale by the United States Department of Agriculture, under the direction of Dr. C. V. Riley, Entomologist, and one of the concluding sentences of his report reads:—" Finally, the examinations, taken as a whole, show how thoroughly graminivorous a vegetarian the sparrow is, as a rule."

At the meeting on 21st April, 1885, at Washington, of the Council of the American Ornithologists' Union, the Committee rendered its final report of considerations as to the serviceableness or otherwise of the English sparrow, these being based on information received in reply to their circulars or inquiries sent to localities of the entire United States and Canada.

The report, which contains a great amount of solid information, is too long for insertion here; but relatively to the points now under consideration, the united "verdict of the ornithologists," formally given, is "that there is an overwhelming mass of testimony to the effect that the sparrow drives away certain of our most valued species of native birds"; and in reply to the question on the circular, " Is it an insect-eater or a seed-eater ?)" that every reply to this question, based on dissection, agrees in attributing to this bird a diet almost wholly vegetable.

In concluding this valuable report, Miss Ormerod and Mr. Tegetmeier say:—

In the present space it is impossible to enter fully on this important national matter, but still we find, in addition to what all concerned know too well already of the direct and obvious losses from sparrow marauding, that there is evidence of the injurious extent to which they drive off other birds, as the swallows and martins, which are much more helpful on account of their being wholly insectivorous; also that, so far from the sparrow's food being wholly of insects at any time of the year, even in the young sparrows only half has been found to be composed of insects; and of the food of the adults, it was found from examination that in a large proportion of instances no insects at all were present, and of these many were of kinds that are helpful to us or harmless. Also, it is well on record that there are many kinds of birds which help us greatly by devouring insects, and that where sparrows have systematically been destroyed for a long course of years all have fared better for their absence; and also attention should be drawn to the enormous powers of increase of this bird, which under not only protection, but, to some extent, absolute fostering, raises its numbers so disproportionately as to destroy the natural balance.

Here, as yet, we have no movement beyond our own attempts, to preserve ourselves, so far as we legally may, from sparrow devastations; but in the United States of America (on the evidence of which we have given a part) the Association of the American Ornithologists gave their collective recommendation that all existing laws protecting the sparrow should be repealed, and bounties offered for its destruction; and the law protecting the sparrow has been repealed in Massachusetts and Michigan. Dr. Hart Merriam, the Ornithologist of the U.S.A. Board of Agriculture, also officially recommended immediate repeal of all laws affording protection to the English sparrow, and enactment of laws making it penal to shelter or harbour it; and Prof. C. V. Riley, Entomologist to the Department, similarly conveyed his views officially as to it being a destructive bird, worthless as an insect-killer.

"In Canada, on 6th October, 1888, at the annual meeting of the Ent. Soc. of Ontario, Mr. J. Fletcher, Entomologist of the Experimental Farms of the Department, strongly advocated the destruction of the sparrow; and in reply the Hon. C. W. Drury, Minister of Agriculture (who attended the meeting as head of the Agricultural Department of Ontario), stated 'that this destructive bird was no longer under the protection of the Act of Parliament respecting insectivorous birds, and that everyone was at liberty to aid in reducing its numbers.'

"Reasoning on the same grounds as to procedure in this country, we believe that similar action is, without any reasonable cause for doubt, called for here. The amount of the national loss, by reason of ravaged crops and serviceable birds driven away, may be estimated, without fear of exaggeration, at from one to two millions a year.

"We do not pretend to offer suggestions as to what may be considered fitting to do by Government authority, but much of their own protection lies in the hands of farmers themselves; and Sparrow Clubs, well worked, and always bearing in mind that it is only this one bird that is earnestly recommended to their attention, would probably lessen the load to a bearable amount; and we believe that subscriptions, whether local or from those who know the desirableness of aiding in the work of endeavouring to save the bread of the people from these feathered robbers, would be money wisely and worthily spent."

Adulterated Honey.

Recently a deputation, representing the Bee-keepers' Association of New South Wales, waited upon the Minister for Mines and Agriculture, with the object of having the adulteration of honey brought under the scope of the Public Health Act. The matter was referred to the President of the Board of Health, who points out that the Board is desirous of seeing full advantage taken of the protection afforded by the section of the Act relating to the adulteration of foods like honey, and that if samples of suspected honey were submitted the Board would have them examined by the Government Analyst, with the object of taking such steps as might be necessary to preserve the wholesomeness of this article.

Improvements in Wheat Culture.

The following extracts are from an article by Mr. M. A. Carleton, of the Division of Vegetable Physiology and Pathology, United States Department of Agriculture, Washington. The observations, confirming, as they do, similar investigations conducted in this Colony, will be of especial interest to those employed in wheat-growing here:—

"There is probably no agricultural product more variable as to supply and demand, and consequently more subject to variation in price, than wheat. It may bring a high price for one or two seasons, and then fall greatly in value for several years in succession. These fluctuations are due to a number of causes, among which may be mentioned: (1) The fact that the natural wheat regions are, above all others, subject to extreme changes of climate, intermingled with seasons of prolonged and severe droughts with occasionally shorter seasons of too-abundant rainfall, all tending to make wide variations in the wheat harvest; (2) a rise in price causes the crop to be planted more extensively, and as a consequence the supply is increased and the price goes down; (3) war may increase the foreign demand; (4) a greater market is sometimes opened in foreign countries by commercial treaties, which reduce or abolish the tariff on wheat or flour imported into these countries; (5) an unusual demand for feed for stock will necessarily increase the acreage devoted to the growth of other cereals, especially corn, and proportionately lessen the acreage in wheat; (6) feeding wheat to stock, as

was done over a year ago in the West, may materially lessen the surplus of wheat on hand; settlements in new countries often greatly increase the acreage given to wheat.

"Some of these causes of variability in the profits to be derived from wheat-raising cannot be overcome merely by adherence to correct principles of agricultural science. There are, however, various instances in which there is room for an improvement in agricultural practice that would, without any question, make wheat-culture much more profitable than it is at present; indeed, during the recent period of low prices the uncertainty of yield and the inferior quality of the product had probably more to do with restricting profits than the actual decrease in price itself. Investigations made by the writer in the wheat districts of the Great Plains show that in some places an average of even 15 bushels of wheat per acre, at 40 cents. (1s. 8d.) per bushel, may be profitable.

Methods of Tillage.

"With wheat, as with many other crops, the proper treatment of the soil may be considered half the battle. In wheat-growing a great deal depends upon local conditions of soil and climate; and as these conditions in any particular locality can be thoroughly understood only by long residence in that locality, the experiment stations in the several States should be able to give the most reliable advice relative to the adaptability of wheat to any particular section. Nevertheless, there are a few general principles which it seems proper to discuss here.

"On large farms, which are especially common in the West, there is much actual area lost by sheer wastefulness in cultivation. For instance, a wide strip is left for turning ground, and then, perhaps, not utilised, and again the plough may be allowed to run quite a distance before it begins turning a furrow. If the amount of land thus thoughtlessly wasted could be calculated the result would be surprising. Suppose a field of 200 acres produces 3,800 bushels of wheat, does this necessarily mean a yield of 19 bushels per acre? Is it not more likely to be 20 bushels per acre from an area of only 190 acres actually growing the crop? If the latter be true, there is a clear loss of 10 acres, or 200 bushels, which, at 40 cents per bushel, would pay more than half the bill for threshing the entire crop, even at a rate of 4 cents per bushel for the work.

"It is found, as a rule, that very early and deep ploughing is best. This is especially true in arid regions, where conservation of moisture is a very important matter. In such districts subsoiling may be practised also to advantage, according to the nature of the subsoil.

"For spring sowing, ploughing should generally be done in the fall; and for fall sowing, ploughing should be done soon after harvest. In spring-wheat districts, summer fallowing is sometimes practised. This gives a much needed rest to the land during constant wheat cropping. Root or forage crops may, however, occasionally serve the same purpose, besides being a source of additional profit from the land.

"After considerable experience and investigation, the writer has come to the conclusion that a roller should never be used on the Western plains, except in the case of late ploughing; and then it should be used only before drilling. This is owing to the fact that roughness of surface is valuable for holding moisture and checking the injurious action of dry winds. The seed bed should be made very fine and mellow before drilling, and wherever

possible the drill rows should run east and west. Strict attention to such general principles as the foregoing will result in an increase in certain seasons of as much as 5 or 10 bushels per acre."

Wheat is just like any other product, in that prices are badly affected by an over-supply of a poor article. A moderate production of a good article, brought about by a diversified and scientific system of farming, with a proper outlet for the product, is sure to develop and maintain a profitable industry.

Effects of the Tuberculin Test on the Milk.

In view of the interest excited by tuberculin injections, it may be well to cite the results of some experiments carried out by E. A. de Schweinitz, in the United States, on the effect of these injections on the milk of healthy and diseased cows. The inoculations were made with varying amounts of tuberculin on a healthy cow, two diseased ones, and eight which had been condemned by the tuberculin test and were to be killed. From these investigations it was found that with regard to healthy cows there was practically no variation in the amount of fat in the milk. Even in cases where large injections of tuberclin, amounting to 30 c.c. were made, the same held true. When applied to the two diseased animals the tuberculin was found to exercise a decided decrease on the amount of fat in the milk; while the second and third injections were found to cause no appreciable rise in the temperature of the animals. With the eight condemned cows, however, two animals which showed no rise in temperature on injection exhibited no decrease in the percentage of fat in the milk. In the case of the others of the condemned lot, it was noted that where the animals showed a rise in temperature on injection there was a decided decrease in the percentage of fat in the milk. The investigator, however, came to the conclusion that there was apparently no relationship between the decrease in fat with the extent of the disease. The oldest cases seemed to give the least change in fat; while the newer cases gave the largest variation. He is also of the opinion that the variation in fat is to be attributed partly to the fever; and that, taken in conjunction with the rise in temperature, this variation might be considered as corroborative evidence. Reference is also made to the results of experiments carried out by the Paris Committee and the International Congress of Veterinary Medicine at Berne on the value of tuberculin. It has been asserted that the tuberculin injection has a tendency to cause the disease to spread more rapidly. An animal condemned for tuberculosis was kept for a year. At first small doses of tuberculin were injected until she ceased to give a reaction, and was again apparently well. The injections were increased in number and quantity, until at the end of the year the animal received an injection of 100 c.c. As she had previous to this inoculation received altogether during the year 565 c.c. of tuberculin, the total amount of tuberculin injected was 665 c.c. It was found that no change occurred in the amount of fat, nor was any increase in temperature manifested after the final inoculation of 100 c.c.—Dr. C. M. Aikman, *Agricultural Gazette.*

Short Root Pruning Young Trees.

In a recent number of the *Indian Forester*, Mussorie, reference was made to a method of root pruning adopted by a prominent Texas orchardist several years ago, and claimed to possess many advantages. The idea is that when

one to two year old trees are planted, the roots are to be cut back to stubs about an inch long and the trunk pruned to a branchless whip from 1 to 3 feet high. In planting, a hole 2 inches in diameter is dibbled in well-worked soil, and the tree, with the roots cut off cleanly in a horizontal plane, inserted, and the earth firmly tramped round it.

It is maintained that under this system new roots grow strong and deep, and almost directly downward, thus avoiding the drought that often affects the surface roots of young trees planted in the ordinary method.

Successful experiments are cited in support of this method, both in the United States where it originated and at the Botanic Gardens, Saharampur, India.

Concerning this subiect, the Fruit Expert, Mr. W. J. Allen, says:—

"This method of cutting all lateral roots back to within 1 to 3 inches of the tap root, would, I consider, answer very well if the pits were planted, and the young trees grown and budded or grafted (as the case might be) without moving the stock—that is, the only moving the tree would have would be from the nursery to the orchard where it is to be planted out. I consider that peach and apricot trees grown in this way would stand this method of pruning; but the experience of all nurserymen is that the purchaser always prefers a well rooted tree, with plenty of small roots, and to obtain this it is necessary to remove the young tree the winter following the insertion of the dormant bud into the stock, prune the roots fairly short, and then plant. By this means he obtains a small tree with plenty of small roots, and one which is easily started when planted out in orchard form; but were the roots of these trees cut hard back as suggested, I doubt whether he would get 50 per cent. of his trees to grow, and these would only make a very poor start. I am speaking from experience, as last year I saw this method tried by a very careful orchardist, and more than half of the trees died—the balance making but a poor growth, although they received every care and the best of cultivation.

"Forest trees would be better to have part of their tops cut back, as well as their roots pruned to (say) 8 inches of the tap root, but this would be applicable only to the deciduous varieties.

"I would recommend the planter leaving a good supply of roots, see that these are well spread out when planting, and do not attempt the short-root method of pruning until the trees are grown as above-mentioned—that is, never moved until taken from the nursery to the orchard."

Poultry Yard.

Runs and Feeding.

M. Louis Brechemin, Secretary to the National Poultry Society of France, writes as follows to *L'Agriculture Nouvelle*:—

"It is asked whether a run of 100 metres (119 square yards) would be sufficient for 100 fowls. Assuredly not. At the end of three months the earth would be infected, and there would be every reason to fear an epidemic, which would decimate the flock in a few days. For 100 fowls it would be necessary at least to have 400 metres (476 square yards) of ground. One of my friends, who only has this space of ground, has adopted the following plan: Dividing the ground into two equal parts, he has erected in each a poultry-house. His 100 fowls occupy for three months one of these sections, when he removes them to the other. The earth in the part vacated is dug

over, and sown with grass-seed. When this grows it is regularly cut for two months, so that when the fowls are brought back again the ground is perfectly sweet and healthy. Each house when unoccupied is well-washed out and disinfected; after a few days, when it is dry, the house, built of wood, is limewashed. For three years that my friend has carried out this plan he has never had a sick fowl.

"The poultry runs are placed in a kitchen garden, which is benefited by the manure from the fowls. They are bordered by chesnut trees, which always give shady and cool corners to the fowls. Only seeking to produce eggs for sale, my friend does not keep any male birds. Each year he purchased, in the month of July, fifty pullets about three months old, which cost him, including carriage, 1s. 3d. each. The poultry-yard is thus renewed in half. The fifty hens which are intended to be sold are fattened upon a paste made of potatoes and fine barley-meal, and can be sold easily at 3s. each. The young pullets, being well fed, commence to lay towards the end of October, and their eggs, though not very large, sell easily at 1¼d. to 1½d. each, by reason of their freshness.

"Each fowl receives every day 125 grammes (nearly 1½ lb.) of dry food, 25 grammes (about ¼ lb.) of grain in the morning, at 6 o'clock in summer and 7 o'clock in winter; at noon 75 grammes (about ¾ lb.) of soft food, composed half of soaked biscuits, quarter of smoked meat, and quarter of bran; in the evening from 4 to 6 o'clock, according to the season, 25 grammes (about ¼ lb.) of grain. The grain is a mixture of wheat, buckwheat, and oats—buckwheat chiefly. The soft food, dry, weighs 75 grammes (about ¾ lb.), but after the addition of water is more than 125 grammes (nearly 1½ lb.) Grass, pickings from salads, and refuse from the kitchen are given, and when very plentiful the night ration is reduced accordingly.

The cost of this food is 20 francs for 100 kilos (8s. per cwt.) Notwithstanding the reductions when green stuff and house scraps are abundant, each fowl consumes food to the extent of 7s. 3d. The food given is excessively rich in azote, and the fowls lay abundantly. Each year the total eggs produced are 15,000, thus much exceeding the ordinary average. In consequence of this excessive laying the fowls would give poor results the third year; they are, therefore, killed off when two years and three months old. Eggs are sold to pastrycooks, several restaurants, two boarding-houses, and a certain number of special customers, the total product reaching 1,600 francs, whilst the cost is 900 francs. This result is ordinary; it is, nevertheless, an occupation lucrative for my friend's wife, who gives two hours every day to the care of her poultry-yard.

"These particulars are not those usually published by many others, but they have the advantage of being correct. It is necessary to remember that for these 100 fowls my friend has to buy the whole of their food. The amateur who only keeps half a score for supplying his own table with eggs can feed them more cheaply by reason of the scraps obtained from his household. The farmer can procure his food at a lower price, and his fowls in their wanderings obtain a large amount of natural food, so that feeding should be less expensive to him.

Milk Test-flasks.

In his Annual Report, the Dairy Instructor at the Hawkesbury Agricultural College draws attention to the fact that a large number of test-flasks on the market are incorrectly graded. Five dozen test-bottles were obtained from one of the Sydney firms, and on examination a large percentage were found

to be incorrectly graded; some as much as six-tenths and eight-tenths. Mr. Guthrie, Chemist to the Department, has already examined, at different times, a considerable number of test-flasks, and the Minister desires it to be notified for the information of those in doubt as to the accuracy of these vessels, that the Department will undertake the examination of any that are submitted for rectification.

Egg-laying of the Codlin Moth.

Prof. Slingerland has been investigating the habits of the codlin moth. He finds that the egg is deposited on the side of the fruit, and not in the calyx. It is a little smaller than a pin-head, flattened and transparent, so that the colour of the apple shows through it. Under the microscope the surface is marked with lines, and looks like a fish-scale. At first they were difficult to make out, but afterwards easy.

After careful investigations he found hundreds of eggs in the orchard, scattered over the fruits. The young worm was hatched out in about ten days, and at first is little larger than a hair. It remains on the surface several hours, then crawls about till it reaches the calyx, where it works its way between the lobes, and enters the cavity.

The practice of spraying as soon as blossoms fall is effective, because the calyx lobes are then open, and the Paris green is readily deposited within the eye; and as the worm does not eat till it enters the eye, its first dose will be its destruction.

The closing of the calyx and lobes soon after spraying is an advantage, because it keeps the poison from being washed away by rains; but if the spraying is delayed till after the calyx closes it will not be so effective.

The second brood does not always enter the calyx, but eats in the side of the fruit, especially if protected by an overhanging leaf.—*Canadian Horticulturist.*

Treatment of Ramie.

From the *Journal of the Jamaica Agricultural Society* we take the following report of a Committee appointed by the Society to inquire into the working of the McDonald-Boyle machine for treating ramie stems. The difficulty of finding a machine suitable for this work has hitherto been the great drawback to the profitable cultivation of the fibre. The Committee say:—

"The machine is of very simple construction, consisting essentially of a revolving drum armed outwards with transverse flanges, which strike the ramie stems against the lip of the feeding-plate. A boy feeds three or four stems into the machine to about two-thirds of their length, and then reverses. The back action is required to finish the cleaning.

"The power required to drive the machine is not great, and the inventors state that a six-horse power engine is all that is necessary for forty of these machines. It worked as well with dry stalks as with green; and even when the stalks of different lengths and sizes were put through, the work was perfectly performed, though more slowly. There was no wood left on the ribbons, there was no fibre wasted, and the epidermis was so broken that it was completely cleaned off in the degumming process.

"One boy fed the machine from a table where the ramie stems were placed, and hung the ribbons on a rail on the other side. The fibre came out untangled and unbruised.

The following were the tests made:—

"1. 38½ lb. of stems. These were ripe stalks, which had been cut between 3 and 5 p.m. by Mr. Moxsy, near Chapelton, on the 15th instant, so that they were dry. The bundle was said to have weighed 50 lb. when freshly cut. The stems were run through in twenty-two minutes, and the wet ribbons weighed 8¼ lb. Fifteen ounces of the wet ribbons were then taken and submitted to the degumming process. They were boiled in a chemical solution for an hour and a quarter, and for the next half hour were passed successively through three baths of different chemicals, yielding 4½ oz. of wet filasse. It was in a condition ready for combing and spinning, and there was no loss in lustre or strength.

"2. 4 lb. of mixed stems were put through the machine, 2 lb. being six weeks old, and 2 lb. three months old. They were supplied from Hope Gardens, and were passed through in 2 minutes 50 seconds. The object of this test was to see how the machine would act if stems of different length and various ages were used mixed together. The work done was satisfactory, but it was evident that the best work is obtained if stems of the same age and thickness are used at the same time, especially as the machine can be adjusted to suit various thicknesses, such adjustment would rarely in practice have to be made, and when necessary can quickly and easily be effected.

"3. 12 lb. 14 oz. of stems from Hope Gardens, barely a quarter of an inch thick, were decoritated in twelve minutes, and yielded 2 lb. 4 oz. of ribbons. These had been grown in shade.

"4. 28 lb. of ripe stems from Hope Gardens were passed through in twenty-seven minutes, and gave 4 lb. of ribbons.

"5. 20½ lb. of stems yielded 3½ lb. of ribbons in twenty minutes.

"The summary of these five tests is:—

Test.	Weight of Stems. lb. oz.	Time in Minutes.	Weight of Ribbons Wet. lb. oz.
1	38 8	22	8 4
3	12 14	12	2 4
4	28 0	27	4 0
5	20 8	20	3 8
Total	99 14	81	18 0

"At a later test we were not present; but the secretary and assistant-secretary of the Society were in attendance, and 50 lb. of green stems yielded 12 lb. of wet ribbons, which were degummed, and gave 1 lb. 11 oz. of dry filasse.

"In the earlier tests many of the stems tapered to points less than a quarter of an inch. These were not completely cleaned, and had to be removed. These points should be removed with the leaves in the field—a practice which would simplify the work of the labourers, give a better percentage in the yield of the machine, and a better class of filasse.

"As there is nothing to get out of order in this simple machine, and no possibility of clogging, we do not see why the results on a large scale should not be as satisfactory as the tests to which we have submitted the machine.

"We believe we can safely commend the machine to the earnest consideration of planters in Jamaica; but at the same time we think the whole process can only be operated successfully on a large scale by the central factory system."

Replies to Correspondents.

Borers.

Mr. W. Clements, Towamba, *viâ* Eden, writes :—

"I have an orchard of young fruit trees about 4 or 5 years old, and they have been doing well until lately, when I found some withering and drying. At first I thought it was caused by a severe frost we had here recently, but on close examination I found the trunk, from the ground up to the limbs, completely full of small holes large enough to allow you to put the point of a knitting needle in. On poking a piece of wire into these holes, I discovered a small insect resembling a beetle or grub without wings. These insects are fetching out of the tree dust resembling that made by a white ant in pine-wood. The trees affected so far are apple, apricot, and cherry."

From the description given, the Fruit Expert, Mr. W. J. Allen, thinks the insect referred to must be the borer, *Xyleborus dispar*, which chiefly attacks apples, pears, and plums; but is also found in apricot, cherry, nectarine, and peach trees.

Once the borers have got a good footing, it is almost impossible to adopt any effective remedial measure short of digging up the affected tree and burning it. Where the limbs or branches only are attacked they should be removed and destroyed by fire, and the tree sprayed with tar water, prepared as follows :—

Boil 1 lb. of coal tar in 2 gallons of water for twenty minutes, and while boiling mix with 100 gallons of cold water; stir thoroughly. The smell is disliked very much by insects, and may prevent any further spread from the outside. It is not certain that this treatment will give entire satisfaction, as this borer is one of the hardest insects to deal with, and once having gained headway, it is one of the most difficult pests to exterminate.

Another preventive, recommended by John Wright, a prominent English authority, is a dressing prepared as follows :—

Soft soap	1 lb.
Flowers of sulphur	1 lb.
Quicklime	1 lb.
Tobacco juice	1 gallon.

Dissolve the soft soap in 1 gallon of boiling water, add the sulphur, slack the lime, add the tobacco juice to the soap and sulphur, work all well together, and apply with a brush thoroughly. It is, however, too late in the season to use such a dressing now. It should always be applied before the trees have started to grow.

I would recommend looking carefully to the drainage and care of the soil. If the trees are in any way weakened by growing in poor or wet soil, or

allowed to grow without pruning and with poor cultivation, they are much more liable to become subject to the attacks of disease and insects.

Of course, a good many of the grubs can be destroyed by inserting a small wire into the hole; and when the attack is slight a tree might in this way be saved.

Another borer is the flat-headed apple-borer, and this may be successfully treated by injecting kerosene emulsion into the holes. Kerosene emulsion is mixed as follows:—

Take ½ lb. of hard soap, and dissolve in 1 gallon of boiling *soft* water (rain), after which add 2 gallons of kerosene, and churn the mixture for ten minutes. In making the emulsion it is an essential condition of success that the liquids should be as warm as possible. Dilute with 60 gallons of water.

Lucerne on Apparently Unsuitable Soil.

A correspondent at Branxton being anxious to try lucerne for dairy-cattle on land which is regarded by many people as unsuitable for that crop, has written to the Department for advice.

Mr. Geo. Valder, Principal, Hawkesbury Agricultural College, who, at the Wagga Wagga Experiment Farm, demonstrated the possibility of producing splendid crops of this fodder on soils and situations that were considered to be ill adapted for it, reports:—

"In connection with growing lucerne on lands generally regarded as unsuitable, I would advise, first, deep ploughing, or ploughing and subsoiling, to a depth of at least 1 foot, if possible; then bring to a fine tilth, by means of harrows, roller, &c., and sow the seed in drills about 1 foot apart, sowing not more than 4 lb. of seed per acre. There are many drilling machines suitable for this purpose, which will sow from 1 foot to 14 inches apart. In order to obtain the best results, it is necessary to cultivate between the drills after each cutting.

"The best time to sow is in early spring."

Old Roads in Grass and Cultivation Paddocks.

A Bowning correspondent asks for advice as to the best thing to do with old road tracks running through his land.

Mr. Geo. Valder, Principal, Hawkesbury Agricultural College, says that in grass paddocks the best way to treat the road tracks is to stir them up with either a cultivator or light plough, and sow, in April, with sheep's burnett. If for cultivation, plough up and sow in February with rape, then feed off as soon as crop is ready, or plough the crop in.

Harvesting Sun-flower Seed.

In reply to inquiries as to the best method of harvesting sunflower seed on a commercial scale, Mr. Valder, Principal, Hawkesbury Agricultural College, reports:—

"Allow the heads to ripen fairly well before pulling, but do not leave them till they are too dry, or much of the seed will fall out and be lost. Cart the heads into a shed or barn where they will be protected from damp, but be fully exposed to the air. Do not pile them in heaps, but spread them out as much as possible. The heads will soon dry, and the seeds can then easily be threshed out. Afterwards put them through the winnower to clean up."

Eradicating Briars.

Mr. W. A. H. Burkitt, of Goulburn, desires to know the best method of eradicating briars from cultivation and also grazing paddocks. He has 100 acres to do.

Numerous specifics have been tried with varying success for the eradication of briars and other useless vegetation, but they are too expensive for large areas. There does not appear to be any better plan than a team of bullocks and drag-chain, to be used while the soil and subsoil is well saturated with moisture. If the briars are not too large, a horse or pair of horses may be used in the same way. The briars will, in nearly all cases, spring up, and while the shoots are young they should be dug out.

"Lex" writes: "I want to get the *Agricultural Gazette* complete for the year 1890. Can any of your subscribers or correspondents let me have it on payment. Please ask in your columns." If any of our readers have copies for the year mentioned which they desire to dispose of, we will be pleased to place them in communication with "Lex."

AGRICULTURAL SOCIETIES' SHOWS, 1897.

Society.	Secretary.	Date.
Dapto A. and H. Society	A. B. Chippendall	Jan. 6, 7
Albion Park A. and H. Association	H. Fryer ...	,, 13, 14
Gosford A. and H. Association	W. McIntyre ...	,, 29, 30
Wollongong A. and H. Society	J. A. Beatson ...	Feb. 3, 4
Cobargo A., P., and H. Society	T. Kennedy ...	,, 16, 17
Ulladulla P. and A. Society	C. A. Cork ...	,, 16, 17
Berrigan A. and H. Society	R. Drummond...	,, 17
Riverina P. and A. Society (Cereal)	W. Elliott ...	,, [illegible]
Manning R. (Taree) A. and H. Association	H. Plummer ...	,, 18, 19
Lithgow A., H., and P. Society	J. Asher ...	,, 18, 19
Robertson Agricultural Society	R. J. Ferguson .	Mar. 2, 3
Bega A., P., and H. Society	J. Underhill ...	,, 3, 4
Southern New England (Uralla) P. and A. Association	Jas. Leece ...	,, 9, 10
Tumbarumba P. and A. Society	W. Willans ...	,, 9, 10
Tenterfield Intercolonial P., A., and M. Society ...	F. W. Hoskin...	,, 10, 11, 12
Coonabarabran P. and A. Association	E. May-Steers...	,, 11
Oberon A., H., and P. Association	A. Gale... ...	,, 11, 12
Berrima District (Moss Vale) A., H., and I. Society ...	J. Yeo	,, 11, 12, 13
Cobargo A., P., and H. Society	T. Kennedy ...	,, 16, 17
Crookwell P. and A. Association	W. P. Levey ...	,, 18, 19
Lismore A. and I. Society	T. M. Hewitt ...	,, 18, 19
Walcha P. and A.	F. Townsend ...	,, 23, 24
Cudal A. and P. Society	C. Schramme ...	,, 24, 25
Blayney A. and P. Association	J. Clements ...	April 1, 2
Mudgee A., P., H., and I. Association	J. Cox	,, 6, 7
Liverpool Plains (Tamworth) P., A., & H. Association	A. M'Leod ...	,, 6, 7, 8
Warialda P. and A. Association	W. B. Geddes...	,, 7, 8
Williams River A. and H. Association	W. Bennett ...	,, 7, 8
[illegible]	[illegible]	7, 8
[illegible] and P. Association	W. [illegible]	[illegible] 8, 9
Gulgong P. and A. Association	C. E. Hilton ...	,, [illegible]
Queanbeyan P. and A. Association	W. D. Wright...	,, 13, 14
Royal Agricultural Society	F. Webster ...	,, 14–20
Moree P. and A. Society	S. L. Cohen ...	,, 21, 22
Clarence P. and A. Society (Grafton)	J. Wilcox ...	,, 27, 28
Bathurst P. and A. Society	W. G. Thompson	,, 28, 29, 30
Hunter River (West Maitland) A. and H. Association...	W. C. Quinton	,, 28, 29, 30
Hay Hortic. Society...	J. Johnston ...	May 5
Namoi P. and A. Association (Narrabri)...	J. Riddle ...	,, 5, 6
Hawkesbury District Agricul. Association (Richmond)	C. S. Guest ...	,, 6, 7, 8
Upper Manning A. and H. Society	W. Dimond ...	,, 12, 13
Wellington P. and A. Society	R. Porter ...	,, 13, 14
Upper Hunter P. and A. (Muswellbrook)	J. C. Luscombe.	,, 19, 20, 21
Nyngan and District	E. H. Prince ...	June 1, 2
Brewarrina P. and A. Association	H. L. Cathie ...	,, 7, 8

Society.	Secretary.	Date.
Cobar P. and A. Association	W. Redford	June 9, 10
Deniliquin P. and A. Society	H. J. Wooldridge	July 13, 14
Hay P. and A. Association	Chas. Hidgcock.	„ 22, 23
Riverina P. and A. Society (Jerilderie)	W. Elliott	„ 27, 28
Condobolin P. and A. Association	H. W. Grey Innes.	„ 28, 29
Lachlan P. and A. Association (Hillston)	Thos. Cadell	„ 30
Gunnedah P., A., and H. Association	J. H. King	Aug. 3, 4
Forbes P., A., and H. Association	F. Street	„ 5, 6
Corowa P., A., and H. Society	E. L. Archer	„ 19, 20
Cootamundra A., P., H., and I. Association	T. Williams	„ 25, 26
Grenfell P., A., H., and I. Association	G. Cousins	„ 25, 26
Northern Agricultural Association	C. Poppenhagen	Sept. 1, 2
Murrumbidgee P. and A. Association (Wagga)	P. W. Lorimer..	„ 1, 2
Burrawong P. and A. Association (Young)	C. Wright	„ 1, 2
Manildra Agricultural Society (Ploughing Match and Horse Parade.)	G. W. Griffiths..	„ 8
Albury and Border P., A., and H. Society	Geo. E. Mackay	„ 8, 9
Murrumburrah P., A., and I. Association	Miles Murphy	„ 8, 9
Yass P. and A. Association	Thos. Bernard	„ 9, 10
Wallsend and Plattsburg A. H. P. P. and C. Society	G. Gilmour	„ 9, 10, 11
Junee P., A., and I. Association	T. C. Humphrys	„ 15, 16
Burrowa P., A., and H. Association	J. H. Clifton	„ 16, 17
Cowra P., A., and H. Association	Fred. King	„ 22, 23
Temora P., A., H., and I. Association	W. H. Tubman.	„ 22, 23
Moama A. and P. Association	C. L. Blair	„ 29
Narrandera P. and A. Association	J. F. Willans	Oct. 6, 7
Berry Agricultural Association	A. J. Colley	Nov. 24, 25, 26

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Society.	Secretary.	Date.
Dapto A. and H. Society	A. B. Chippendall	Jan. 12, 13
Albion Park A. and H. Association	H. Fryer	„ 19, 20
Kiama A. Association	J. Somerville	„ 25, 26
Gosford, A. and H. Association	W. McIntyre	„ 28, 29
Alstonville Agricultural Society	H. R. Elvery	Feb. 1, 2
Wollongong A., H., and I. Association	J. A. Beatson	„ 2, 3
Robertson Agricultural Society		
Morn[illegible]	R. G. Ferguson..	„ 8, 9
[illegible]iety	John Jeffery	„ 9, 10
[illegible]n A. and H. Association	R.C. Leeming	„ 10, 11
[illegible]ng River A. and H. Association (Taree)	H. Plummer	„ 10, 11
Nepean District A. H. and I. Society	E. K. Waldron..	„ 10, 11
Berrigan A. and H. Society	R. Drummond ..	„ 16
Ulladulla A. and H. Association (Milton)	C. A. Cork	„ 16, 17
Kangaroo Valley A. and H. Association	W. Randall	„ 17, 18
Tumut A. and P. Association	B. Clayton	„ 26, 27
Southern New England P. and A. Association (Uralla)	J. D. Leece	Mar. 1, 2
Bega A., P., and H. Society	J. Underhill	„ 2, 3
Upper Hunter (Muswellbrook) P. and A. Association	J. C. Luscombe.	„ 2, 3, 4
Tumbarumba and Upper Murray P. and A. Society	W. Willans	„ 8, 9
Lismore A. and I. Society	T. M. Hewitt	„ 3, 4
Bombala Exhn. Society	R. H. Cook	„ 8, 9, 10
Tenterfield Intercolonial P., A., and M. Society	F. W. Hoskin	„ 9, 10, 11
Cudal A. and P. Society	C. Schramme	„ 10, 11